

# **ENVIRONMENTAL POLLUTION AND HEALTH HAZARDS IN INDIA**

**R KUMAR**

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# **ENVIRONMENTAL POLLUTION AND HEALTH HAZARDS IN INDIA**

*Edited by*

**R. KUMAR**



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## **Foreword**

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Chandigarh has inspired many men and women to do their bit for the welfare of people in fields of health and environment. Dr. R. Kumar is one of them. With tremendous patience and energy, he has identified, chased and persuaded several specialists in these two fields to collaborate with him in a unique venture. This book is the result of his efforts and other experts' co-operation to inform the people of what has become vital in today's world. Despite big strides of progress in the world of medicine and surgery, health continues to be the major worry for the mankind. Though a lot of noise has been made at different levels by various individuals and organisations for conservation and improvement of environment, very little has actually been done in this regard. The need to do something urgently and effectively cannot be under-estimated. All those who stress this need are doing a great service to humanity. Information and education are important inputs in the world's efforts to protect or recover the ecological balance. As a worker of the Environment Society of Chandigarh and as a man connected with media, I have felt that there is almost total ignorance about what an average man needs to know about environment and what he can contribute himself towards its improvement. That ignorance has to be attacked from various sides and through many ways. Writing and production of serious books is one of the most difficult methods. That Dr. Kumar thought of it and succeeded in achieving his objective in a fairly short time is commendable.

One does not have to go far to see the relationship between environment and health—of body, mind and spirit. This book succeeds in emphasising that, to ensure his well-being, man has

to produce an ecological balance between himself and his environment. This balance is constantly in danger of being upset by his own activities. So, he has to protect himself from his own activities !

It is true that the relationship between health and environment is a two-way process. The animals and vegetation contribute to conservation of environment and in turn benefit from ecological balance. The human beings too benefit from environment but forget to show a sense of responsibility towards maintaining ecological balance. It is here that the problems in the fields of environment and health crop up. While a number of diseases are directly linked with ecological phenomena, there are others which result from imbalances. Even if a little technical, it is a fascinating subject for study.

The list of contributors, who have made the book a worthwhile attempt, is impressive with some of the top most experts in the fields of medicine, public health, sociology and physical education in addition to environmentalists engaged in voluntary work. A majority of them are from the Post-Graduate Institute of Medical Education and Research, Chandigarh, but there are some from other institutions and disciplines. The variety of subjects not only makes it useful but interesting reading too. It is apparently a collective effort and all those who have pooled their knowledge and experience in producing this book deserve congratulations.

Resident Editor  
Indian Express  
Chandigarh  
20th April 1987

PREM KUMAR

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## CHAPTER 1

# *Environmental Pollution and Health Hazards*

DR. R. KUMAR

The relationship between human health and his environment is a two-way process. We improve our living conditions and increase our comforts but the alterations to the environment may be harmful to our health. The factory has increased our well-being beyond calculation by the goods which it makes so readily available, while the fumes from partly consumed oil and coal, which the factory emits from its chimneys, poison the atmosphere with sulphur dioxide and other noxious chemicals, causing chronic bronchitis and adding to the risk of lung cancer. This dynamic process can be seen at work in agriculture, when pesticides, essential to healthy plant life, build up excessively and harmfully in food, water and air, which the human ingests. Irrigation and dam building, upon which improved food supplies depend, can create favourable conditions for vectors of disease, e.g., for the mosquito carrying malaria and the snail; the intermediate host of bilharzia.

### 1. THE ENVIRONMENT

It is well known that the earth's surface and the environment surrounding it is important to human health. The nature of the soil, air, water, temperature, barometric pressure, wind,

sunshine, cloud, rainfall, humidity and latitude, must all in the last resort have determined man's health and welfare. By controlling animal and vegetable life, man supplied himself with the essentials of life, including clothing, housing and food. The physical characteristics of the globe have determined his diet, and hence his health. The monsoons have favoured rice growing, the trade winds have taken merchants and adventures across the oceans, carrying incidentally the seeds of new vegetation from one part to another, and old diseases to new habitats.

The cloudy atmosphere, which keeps out the sunshine, deprives people of sun-made vitamin D, thus accounting for rickets. Both chronic bronchitis and carcinoma of the lung in Europe are, in some measure, due to atmospheric conditions, which hold down the smoke and turn mist into smog. Where cloudless skies prevail such disabilities would hardly occur, were it not for cigarette smoking; but in strong sunshine fair skins with little pigmentation have an added liability to skin cancer. Rheumatism has for long been related to dampness and cold. Lack of trace elements in the soil causes diseases in animals; cachexia and anaemia in ruminants on soil deficient in cobalt, paralysis (swayback) in sheep on soil with little copper. In man the most pronounced effects of deficiencies are those produced by lack of iodine, iron and copper.

The physical character of the soil or sub-soil, also effects the ease with which water-borne infections spread. The soiling of the land and waterways is a more serious matter in some parts than others. Hookworm is inhibited by dryness. Soiling of the land with faeces is particularly liable to result in pollution of water supplies, which is a factor in the spread of hydatid disease.

Climate may affect pathogenicity of bacteria. Amoebae of dysentery devastates the East. Endemic cholera has, for many centuries, existed in India, spreading in pandemic waves across the world. Low lying lands and lakes, rich in organic matter and salts, sheltered from rain and sun, may have favoured the survival of the delicate vibrio outside the human body. Trachoma resulting in much blindness, one of the oldest diseases known to man, is a disease of poverty and promiscuity (Kumar 1971).

Temperature and humidity, the state of the vegetation, and the abundance or otherwise of animal life, effect the vectors of disease. The mosquitoes, which carry malaria, yellow fever, dengue, encephalitis in many forms filariasis and other diseases, are affected and their disease-carrying qualities altered by a great variety of climatic conditions. Similar influences may affect other 'carriers', which may have determined the distribution of malaria, yellow fever and filariasis. The flies carrying trypanosomiasis, the ticks carrying rocky mountain spotted fever, and the mites carrying scrub typhus, are all sensitive to climatic changes. And so too is the rat; he may have found living better in India where plague prevailed. The reason why plague occurs mainly in the rainy season may be due to the fact that the rat prefers to remain indoors, where fleas increase in numbers, with the seasonal lowering of temperature and humidity to aid propagation.

The environment effects our output of work, our mental alertness, our desire for change and many other attitudes and responses. A mean temperature of 40°F in winter and 60°F in summer, with a relative humidity of about 60 per cent at noon, and high enough at night to precipitate dew, is the most stimulating for mind and body.

To ensure his well-being man has to produce an ecological balance between himself and his environment. This balance is constantly in danger of being upset from his own activities.

Pollution of the environment results from a wide range of human activities: uncontrolled disposal of human excreta and refuse; smoke from coal or oil burning; fumes from motor vehicles; industrial discharges, such as mercury and other chemicals or the products of nuclear fission, which poison cattle and fish and concentrate undesirable substances in human tissues: misuse or overuse of insecticides and fertilizers. Excessive noise causes deafness and in lesser degree destroys equanimity; the extrovert may be stimulated by the transistor radio, but for the introvert it's an intrusion into privacy which irritates and disturbs. Foodstuffs are contaminated in preparation and processing to cause outbreaks of infection. Population explosion, beyond the capacity of the soil, results in malnutrition; overconsumption of food causes obesity, diabetes and dental decay. Association with the

animal world gives rise to zoonotic diseases. The ill-constructed house, overcrowded dwellings and mushroom growths around urban conglomerations cause infections to spread and contribute to mental stress.

## 2. CONCEPT OF HEALTH AND DISEASE

Health signifies a wholeness or soundness of body and mind, but we are confronted with the difficulty of determining its relationship to 'disease'. Health and disease must be intimately related, for if disease did not exist it would be irrelevant to talk of health. The two states are contrasted in our minds, as it were the two sides of a coin—so that when one is present the other is absent.

### 2.1 Health

If anyone should say that only those are healthy who function perfectly in all parts, and that others who function less well are not healthy, he is over-simplifying the definition of health. Also it is clear that the real measure of health is not the Utopian absence of a disease, but the ability to function effectively within a given environment. And since the environment keeps changing, good health is a process of continuous adaptation to the myriad microbes, irritants, pressures and problems which daily challenge man.

The definition by WHO is 'health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.'

Man is a social animal; he cannot easily live for himself alone; there must be harmony with the social environment, so it can be further defined as below:

Health is a state of feeling well in body, mind and spirit, together with a sense of reserve power; based upon normal functioning of the tissues, a practical understanding of the principles of healthy living, a harmonious adjustment to the environment (physical and psychological); it is a means to a richer life of service.

The preservation of health in the group has been defined by WHO as:

"The science and art of preventing disease, prolonging life, and promoting health and efficiency through organised community efforts for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organisation of medical and nursing services for the early diagnosis and preventive treatment of disease and the development of social machinery to ensure for every individual a standard of living adequate for the maintenance of health, so organising these benefits as to enable every citizen to realise his birth-right of health and longevity."

## 2.2 Sickness

In the good olden days man took a fatalistic view of life, death and the disease. Sickness, was something to be endured.

It was not until the middle of the 19th century that man's understanding of nature grew that he could bring the major environmental health hazards to his control. Another half century later achievements of sanitary engineering and preventive medicine in adapting the environment to man were complemented by the success of therapeutic medicine in helping man to conquer some of the diseases.

As a member of society a citizen has an obligation to seek to understand them, and also has the privilege of questioning whether in our effort to add to the comfort and the quantity of life, we may be sacrificing something. Lest the ways in which we are artificially reordering ourselves and our environment may not in some degree diminish our stature in nature and, thereby, rob life of some of its richness and bring sickness. S.S. Bhatti observes in his article that the pace of development is regulated by the animal instincts in man, the process of development itself thrives on a destruction-construction symbiosis. Chandigarh may be cited as an example of disciplined architecture... an environment conducive to peace... and better quality of life.

## 2.3 Health for All

The situation today is that nearly one thousand million

people are trapped in the vicious circle of poverty, malnutrition, disease and despair that saps their energy, reduces their work capacity and limits their ability to plan for the future. For the most part they live in the rural areas and urban slums of the developing countries. Whereas the average life expectancy at birth is about 70-75 years in the developed countries, it is only about 45-55 in most developing countries. Of every 1,000 children born into poverty in the least developed countries, 200 die within a year, another 100 die before the age of five and only 500 survive to the age of 40.

Health for all is the attainment by all the people of the world of a level of health that will permit them to lead a socially and economically productive life. It will mean that there will be a fair distribution among the population of whatever health resources are available. Essential health care will become accessible to individuals and families, in an acceptable and affordable way, and their full involvement.

Alam Ata Conference observed that Primary Health Care is the key to attainment of health for all by the year 2000. It also identified eight essential elements of primary health care. These are : education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and the provision of essential drugs.

It is interesting to note that the various components of primary health care have direct relation to environmental management.

### **3. CANCER**

The relationships between cancer in different parts of the body and various environmental contaminant and pollutants, have been increasingly observed over a long period. It is now generally agreed that between 60 and 90 per cent of all cancers are directly or indirectly related to the environment, that is, related to factors in air, water, solar radiation, living

and working environments and personal choices of diet and ways of life—such as tobacco smoking and alcohol consumption. The assumption is that all cancers are environmentally caused until it can be proved otherwise.

The environmental component in communicable diseases (such as malaria, schistosomiasis, filariasis, and trypanosomiasis) and the efforts to control these diseases through environmental interventions directed at the habitats of their vectors have come in for considerable attention. But the large-scale use of pesticides to protect crops and kill disease-carrying insects, and the increasing use, particularly in developing countries, of growth-promoting substances to increase meat production, have led to increasing concern about chronic toxic effects in human beings which might ultimately be related to cancer. Among these growth-promoting substances are antibiotics, hormones and vitamins.

Viewing the world as a whole, the net effects of many known cancer-causing factors remain substantial, though none is as prominent as tobacco. The Table given below enlists causes of cancer.

### **1.1 : Relative Importance of known Cancer Causing Factors**

Factors	Percentage of all cancer deaths	
	Best estimate	Range of acceptable estimate
Tobacco	30	25-40
Alcohol	3	2-4
Diet	35	10-70
Food additives	<1	—5-2
Reproductive and sexual behaviour	7	1-13
Occupation	4	2-8
Pollution	2	<1-5
Industrial products	<1	<1-2
Medicines and medical procedures	1	0.5-3
Geophysical factors	3	2-4
Infection	10?	1-?

### **3.2 Occupational Cancer**

It is generally considered to be caused by multiple factors. Certain chemicals on their own are known to be carcinogens. Their effects are potentiated by exposure to other chemical or physical agents. Furthermore, there are a number of chemical agents which become carcinogenic in the presence of other chemicals (co-carcinogens) in the work environment.

Control of all these problems requires much more careful observation of the health of workers, coupled with thorough environmental investigation. This, therefore, is one of the areas where WHO has directed attention in the last few years. In December 1980, WHO experts reviewed the effects of combined exposures in the work environment and identified gaps in our knowledge requiring further research.

In his article, Dr. B.D. Gupta has given an account of environmental factors responsible for cancer, as well as the advances made in the treatment of the same, by radiotherapy.

## **4. WORK ENVIRONMENT**

### **4.1 Work**

Work, when fully adapted to human capacities and limitations, is a potent factor in health promotion. It is easy to see that good physical performance is always reflected in good physical development, while mental gratification with achievement and the realisation of goals has a positive effect on mental health. It would include : the absence of (or the total control of) chemical, physical and biological hazards, the adaptation of machines to human performance, the provision of adequate lighting, the provision of rest periods, job enrichment to avoid repetitive tasks and boredom, and a balanced psycho-social environment coupled with job satisfaction.

These conditions require not only human engineering methods and skilful management but also require evaluation of human capacities, tolerance and susceptibilities.

The utilisation of work as a factor in positive health has hitherto been limited and unorganized. We observe, however,

that people who continue working after their retirement maintain better health than those who stop working altogether.

We also note that many physical disabilities can be overcome through work, hence the well-established practice of occupational therapy and vocational rehabilitation. WHO aims to direct attention to the development of methods by which work would become a valuable contribution to health, rather than a health hazard associated with disease.

#### **4.2 Risk and Accidents**

It is rare to find an occupation which does not entail a potential risk to health and sometimes even more than a risk. Several examples come to mind about farm work in the tropics, where workers may be exposed simultaneously to pesticides and excessive heat. In foundry operation occupational exposure may include various fumes, irritant gases, carbon monoxide, heat and dust. In the chemical industry one may find the combined hazards of various chemicals, a mixture of solvent gases and vapours. Even in office work where the physical environment may be fully controlled, several psycho-social stress factors may exist—including pressing demands, interpersonal relations and job security.

In his article Dr. R. Kumar has given a perspective in interpersonal relations, between patients and doctors.

With an estimated 50 million work-related accidents occurring each year many of them resulting in permanent disability, the war on accidents which began over a century ago is being fought on a global scale. In this war against accidents, some success has been achieved in developed countries. But in the undeveloped ones the reduction of accident frequency and severity rates to the lowest figures attainable by human effort, lies a long way ahead. It is towards this eventual goal that the worldwide efforts for the Improvement of Working Conditions are underway with the full support of UN agencies.

Apart from the human agony and despair which they cause, these accidents continue to drain away valuable human resources and place a heavy burden on economy of every country. Another disturbing factor, which make the task of prevention all the more urgent is that while the accident frequency may

have levelled out in most of the industrialised countries, the rate of fatal accidents in the developing countries like India has doubled or even trebled.

Dr. S.N. Mathuria has summarised the effects of environmental hazards on the brain and nervous system, in his article.

## 5. RURAL SANITATION

Most of our villages look like dung heaps. It is very difficult to make people keep their villages and their surroundings neat and clean. The schools, balwadis, other public buildings and houses in the villages are full of dirt and waste of different kinds. The stagnated water acts as the breeding centre for flies and mosquitoes. The open latrine system prevails all-round.

### 5.1 Role of Village Schools

Unless villagers are educated on the need for keeping their villages neat and clean, village sanitation would remain a dream. First of all, the surroundings of the schools and public buildings should be kept neat and clean. If our village schools and their surroundings are kept clean and the teachers and children are in a position to remove even the small paper bits in the village streets and throw them in the nearby dustbins, naturally others in the village will follow suit. If the schools have urinals and latrines constructed at a low cost and are used properly, they will serve as models to the community.

In each Panchayat Union, if the schools which are neat and clean are selected and awarded prizes every year, it will create a healthy competition among the schools and their pupils to keep their surroundings neat and clean. The Health Department should make it obligatory that there should be latrines and urinals attached to each school.

### 5.2 Youth Power

At present, the energy of the youth in the villages is not properly channelised. Our political parties too are not effectively directing their workers in the village reconstruction programmes. They don't mind working for cleaning their

villages and digging pits for latrines once or twice in a month for a couple of hours. But they are not properly motivated.

### **5.3 Waste to Wealth**

People in the villages must be told that the waste collected from the dustbins may be converted into good compost manure. This can be sold or can be used for the vegetable gardens at the noon-meal centres. In the same way the night-soil may also be prepared as good manure.

The villagers may not keep their cow dung and other cattle waste in heaps exposing them to the sun, but be asked to dig compost pits and maintain them properly.

### **5.4 Drainage**

In most of the villages no proper system of drainage is in existence. Since this requires a large allocation of government money, we can encourage people to have soak pits in the front yards of their houses for the water to be absorbed. If the waste water finds a place to go into the backyard, it can be utilised for raising a kitchen garden.

Whenever the sewage of a particular house dirties the neighbourhood, the village youth leaders have to request the concerned head of that family to channelise the waste water properly and avoid making the streets and public places untidy.

### **5.5 Personal Hygiene**

Village sanitation can be improved only where people understand the importance of personal hygiene and its inter-dependence on general cleanliness. If an individual is making his surroundings filthy, then it is his or her health which is affected.

### **5.6 The Drinking Water**

The Health Department has to take effective steps to purify the water in the village wells and tanks. It has to be seen that

the drainage water does not mingle with the river water. People should be educated against the use of the river beds as open air latrines.

### 5.7 Master Plan

The Village Planning Committees have to prepare a master plan for improving the health and sanitation of their villages in consultation with experts in this field. Such a plan should be implemented in a phased manner. For implementing this plan villagers should partly depend upon their own resources. There must be a plan to educate the people first. There must be a link between the programmes for the village sanitation and the programmes for the economic development.

Improving the village sanitation depends upon both economic uplift and providing health education to the people. Training the children in good health practices and keeping their surroundings neat and tidy is very important. After all the habit formation is ultimately responsible for keeping one-self and one's surroundings neat and clean.

## 6. POPULATION

In India an overpopulated country, the growing population is the main cause of environmental destruction. The solution lies not only in containing the population growth, but also by managing the nation's soil and water resources in order to increase production in the fields. If there is poverty and hunger, it is because the managers and scientists of this country have not learnt to use its environment at a high level of suitable productivity.

To survive, the poor often has no alternative but to turn up to the forest wealth—to sell the stolen firewood. The rich indulge in destruction of the environment to satisfy their greed. The development process would involve not only the restoration and enhancement of nature, but also to achieve small family norm.

Engineer R.N. Malik has given some important suggestions for improvement of environmental health, especially about the adverse effects of population explosion.

Women and child are the worst hit in the whole game. So let us study some aspects of environmental health concerning the women and the children.

### 6.1 The Woman

Poor village women are the worst sufferers of environmental destruction. Every morning they have to go on long march in search of fuel, fodder and water—the women may be old, young or pregnant. The march is becoming longer and more tiresome. They are reaching the limits of their endurance. Water, fuel, fodder, building materials and even food to some extent are gathered freely from the immediate environment—but urbanization and advance of cash economy have greatly affected the country's base. Environmental destruction exacerbates women's already acute problems in a way. They do not get any worthwhile health care due to shyness, overwork, and inferior status of women in that society. The plight of women in slums, which is applicable to other poor women has been described in the article on "Environmental impact of slums on health."

### 6.2 The Child

Until the middle of the 19th century, only half of all the children born in the U.S. reached their fifth year, and as recently as 1900 a new-born infant in the U.S. had less chance of surviving a week than did a man of 90. Today, in the economically developed nations, 97 per cent of new-borns live to adulthood. Few children suffer the effects of hunger. Few are infested with worms or other debilitating parasites. The youngsters are spared most of the infectious illnesses—small-pox, tuberculosis and other fevers, dysentery—that carried off so many in the past. Today, very few mothers die in the process of delivery, although mortality rates were relatively high as recently as the 1930s. Indeed, very few persons of any age or sex die of the acute infections in the developed countries, which used to account for the majority of all deaths.

In developing countries like India, despite the advances made in the field of health, the infant and mother death rate is

still very high and so is the incidence of preventable--communicable diseases. It is in this area that Dr. M. Kumar and Dr. R. Kumar have recorded their observations, in Indian context, specially the slums.

## 7. SPORTS AND PHYSICAL FITNESS

There can be no doubt about it : sport offers the best antidote to the tensions and stress that are everyday hazards as our lives become ever more competitive. It offers a respite from our daily cares and contributes a vital element of balance and relaxation.

Individual sports, such as swimming, athletics or gymnastics offer a school for character formation, where self-discipline and stamina can be developed. Individuals exert themselves to improve their own performances, however, modest these may be, and to set themselves new goals. Team games like football, rugby, hockey or water-polo, on the other hand, encourage another set of qualities, among them coordination with colleagues, the team spirit and a sense of belonging, what we call the sporting spirit combines fair play, dexterity, self-control and good manners. It was in this context that Baron Pierre de Coubertin, re-founder of the modern Olympic Games, commented: "The essential thing in life is not so much to win as to fight fair."

Sport has a beneficial effect on general hygiene. There is nothing better than a good shower after the sweat of physical effort, and it is just what tired muscles cry out for.

Besides all this, athletes noticeably smoke and drink less than those who take no regular physical exercise.

At whatever age a person starts, sport has a health-giving effect, although obviously the intensity and the nature of the effort involved varies with age. However, there are some detractors of physical exercise who claim that the benefits which may be derived from sports fall very far short of compensating for the risks entailed. But it is merely to put up a lame excuse for not doing any physical exercise.

Dr. S. Bambah has highlighted the importance of good environment, being conducive to physical fitness and sports and

the role of healthy youth in creating a better environment for living.

## 8. ANIMALS

The role of animals as contributors to the environmental preservation and human well-being cannot be overemphasized, but while discussing the subject of environmental health, we are inclined to over-react about the risks due to animals and their products. We cannot forget that man's health has always benefited in many ways from the animals.

### 8.1 Biological Value

Livestock are an increasingly important source of protein in developing countries. Even "vegetarian" populations are often in fact lacto-vegetarian—adding milk products to their diet. There is no practical substitute for animal proteins in human nutrition.

The WHO/FAO/UNICEF has recommended that vigorous steps should be taken to raise the efficiency of producing milk and meat from cattle, meat from sheep and pigs, eggs and meat from poultry throughout the developing world by applying existing knowledge and by introducing new knowledge in these fields.

Cattle; buffaloes, horses, camels, yaks and llamas still provide more than 80 per cent of the world's total draft power. In India, cattle alone account for an irreplaceable 54 per cent of the energy used in agricultural production.

### 8.2 As Companions

Man has always kept pet animals among his closest companions and such animals provide people all over the world with various forms of much needed healthful exercise and recreation. Recently, animals have been used as direct aids in the treatment of mental illness. Pets can help human beings through their development problems at various stages of maturity. They can encourage a toddler to become assertive and independent, or help a child to overcome feelings of loneliness.

or to alleviate feelings of guilt. An animal companion frequently provides the lonely person, particularly in cities, with the only remaining possibility for love without rejection.

They give timely warning of infectious agents, or the accumulation of toxic materials in the environment. Animals have several advantages as detectors of environmental hazards. Because of their position in a particular food chain, certain species may accumulate toxic substances more rapidly than man; some are more prone than others to become ill or accumulate chemical agents, and can, therefore, be selected as useful detectors.

Virtually every human disease from cancer, cardiovascular disease and stroke to degenerative disease associated with aging and psychiatric disorders may be studied in animals.

### **8.3 Zoonoses**

More than 150 zoonoses and foodborne diseases of animal origin are recognized, and their surveillance, prevention, control and eradication are tasks of considerable magnitude in every country. Reservoirs of zoonoses among domestic animals are the greatest source of danger for man, since it is with these that he is in closest contact. Many foodborne diseases due to animal products are the consequence of zoonoses in domestic animals; the infectious agent may be present throughout the chain from animal foodstuffs, animal production and food processing to food preparation.

Quite apart from the human suffering caused by zoonoses, these diseases are also responsible for great economic losses.

Among the various human foodstuffs, those of animal origin tend to be epidemiologically the most hazardous. Several factors have contributed recently to the increasing necessity for strengthening food hygiene supervision programmes. These include the rapidly increasing world population with its ever greater demands for food: the increase in urban populations with a corresponding decrease in rural populations, which stimulates increased production of processed or semi-processed foods; advances in food technology resulting in new and more "sophisticated" presentation of food, the handling of which may not be properly understood by the consumer; greater use

of agricultural and food chemicals; the increase in environmental pollution which acts unfavourably on food quality in general; more active national and international commerce in food, including the transport of basic materials from areas where hygienic standards may be less than satisfactory; and greater tourist travel.

Foodborne diseases may be caused by various biological agents, such as salmonellae, viruses, protozoa, helminths, arthropods, biotoxins (such as paralytic shellfish poisoning), poisonous-chemicals (such as residues of heavy metals), and other chemical compounds, drugs or food-drug combinations and radionuclides.

Both domesticated and wild animals may inflict injuries on humans of varying severity with their teeth, claws, horns, hoofs, spines, and so on. Animal bites may transmit such infections as rabies, pasteurellosis, rat-bite fevers, or simian herpes virus disease. There is no doubt that they represent substantial costs to the community in the form of treatment of victims, immunization, hospitalization and times lost from work.

High concentration of animals in intensive production units have produced a new series of problems, such as the disposal of animal excreta. Animal faeces, which may contain pathogens, are usually converted into a water suspension, called "slurry". Spontaneous generation of heat such as occurs in heaps of solid manure does not occur in slurry, and therefore, pathogenic microbes and parasitic eggs can survive for a considerable time. The best way to dispose of it is to spray it on arable land, but well away from dwellings and catchment areas since infective aerosols may be carried considerable distances by the wind.

## 9. QUIET LIFE vs. NOISE POLLUTION

### 9.1 Quite Life

A tribal woman even at 80 years of age has her hearing and vision better than those of most teenagers, her teeth sound, her heart strong. Most of her fellow tribesmen are as healthy as she. One explorer noted that life in the tribal villages is so quiet that there is normally less noise than is made by a modern refrigerator.

Some tribals enjoy longevity that would be remarkable in the most medically pampered society. Furthermore, their declining years are almost free of the usual degenerative diseases of old age. Scientists are still puzzled by the tribal's extraordinary health, but their stable, tranquil environment is almost certainly an important factor. When a tribal moves from home to a big city he is beset by a host of ills he has never known before.

## 9.2 Noise

Noise poses quite a different problem. Unwanted sound becomes more pervasive and more intense in urban settings, where transport and industrial sources have particularly high nuisance-values. Acute exposure to intense noise may temporarily impair hearing, while repeated occupational exposures to high levels can cause permanent deafness. Increased noise levels are also associated with cardio-vascular, endocrine, respiratory, neurological and psychological changes, some of which are indicators of increased stress. The various levels of acceptable noise that have been proposed in the past are being evaluated and assessed under WHO's programme, taking into account the levels, frequency, direction and duration of exposure.

Dr. Y.N. Mehra and Dr. Biswas have analysed various effects of noise pollution on environmental health.

## 10. INDUSTRIALIZATION

Industrialization has conferred great benefits on mankind. Physical toil has been greatly reduced. People enjoy higher standards of living, and developing countries in particular are able to spend more money on development and on health.

Unfortunately, the effects on environment have not been beneficial in developing world. These adverse effects include occupational diseases and accidents, pollution, wasteful uses of natural resources and a deterioration of the psycho-social environment. What are these psycho-social consequences of industrialization?

An excessive migration of the rural population to the towns and cities strains these resources of the urban centres. There is often a dense concentration of population. The cacophony of

traffic noise, street cries, voices of playing children and music from radio and television sets in the urban environment can be stressful to both ear and mind.

Unlike in a village, where each individual may know everybody else, the social circle of a city dweller can be extremely limited. People in large cities are inclined to be rather curt and impersonal, and may not appear to have any time to spare for others. It is quite easy for a person, especially in a strange city, to feel "lonely in a crowd". All these characteristics of an industrial or urban centre have been said to predispose individuals to such medical problems as insomnia, neurosis, peptic ulcer and hypertension. Social consequences can be equally developing. In many developing countries where industries are mushrooming, alcohol related problems and drug-abuse have increased rapidly. Prostitution, sexually transmitted diseases, illegitimate pregnancy, marital discord and crimes of violence including child-battering, have become rampant.

Rearing of children can also be a problem in an industrialized society, where they become a grievous economic burden. In such instances, many children lack parental love and may drift into juvenile delinquency. Speaking about the aged, their old way of life, in which respect for the aged and dependence on the extended family were prominent features, may have disappeared. In old age, many persons find themselves without work and without a motive for living. This may be one of the main reasons, that the suicide rate among the old has increased.

Mental health in industry appears to depend on the following factors:

- (a) Job satisfaction.
- (b) Identification and status.
- (c) Attitudes of fellow-workers and the employer.

Shri P.R. Rajagopal has examined in detail, the role of several environmental factors, on environmental health, more so in relation to industrialization.

## 11. AGRICULTURE

The health problems of the workers, entrenched in agricul-

tural environment can be divided into general and special sub-groups. General health problems include those diseases and afflictions that the agricultural worker, in common with everyone else, is exposed to and suffer from. Many of these arise as a result of poor sanitation, inadequate water supply, inadequate accommodation, malnutrition, and a wide variety of communicable diseases both parasitic and bacterial, that affect the entire population.

More specific occupational problems occur as a result of workers' exposure to agents of disease associated with agriculture, which may be biological, physical or chemical.

Biological hazards, obviously include zoonoses—diseases of animals which are transmitted to man in handling animals and animal products. The list of these diseases, include bovine tuberculosis, anthrax and brucellosis. In addition, certain parasite diseases are transmitted as a result of contact with polluted water in farm lands. The common ones are schistosomiasis, ankylostomiasis and leptospirosis.

Chemicals are extensively used in agriculture to control insects, fungi, herbs, rodents and so forth which damage crops. These pesticides and insecticides are harmful to man if not used carefully.

Contamination of food from the use of empty containers has resulted in human poisoning, and so has the accidental consumption of seeds treated with chemicals (mercurials) as preservatives.

## 12. AIR

In the past few decades, man has polluted the atmosphere so heavily that much of the population now breathes a mixture of highly toxic gases with every lungful of air. He has allowed lethal insecticides and weed killers to contaminate his water—a resource from which they cannot be removed by any known method. In fact he has surrounded himself with a new kind of filth which may breed disease as effectively in the long run as the microbial filth of 19th century slums.

Industrial societies are exposing themselves to these man-made poisons in almost total ignorance of their possible delayed or cumulative effects. The dangers of cigarette smoking are now

well known. Once radium was added to pep tonics and advertised as a cure for tiredness and arthritis. It was also used to make luminous paint. Some of the first workers employed to paint luminous watch dials habitually pointed their brushes by twirling them between their lips. Some of them died of radium poisoning and bone cancer over a period of a few years. Most had swallowed only a minute speck of radium in all. Every human being depends on the 12,500 quarts of air, he breathes each day—yet man persists in using the sky as a refuse bin. He began to introduce smoke into the air with his first fire. The volume of soot and smoke increased markedly with the advent of soft coal and the birth of industrial cities. In the years that followed, the volume of pollutants in city air has increased faster than ever, while their nature has changed for the worse. Old-fashioned coal and low-grade fuel oil still send soot and sulphur dioxide into the air; now petroleum refineries, chemical industries and motor cars add vast quantity of pollutants.

Shri Swaraj Chauhan has discussed the role of Supreme Court, and the difficulties inherent therein, to make laws for protection of environment.

### 12.1 Bhopal Disaster

Leakage of MIC gas, from the tank of Union Carbide Factory at Bhopal on the night of 3-12-84, converted the entire Bhopal town into a gas chamber, affecting over 2 lac people. This sudden air pollution brought blindness, respiratory distress, sudden death and so many other miseries instantaneously. The death toll may have been as high as 10,000—mostly poor children and women. This has been described as one of the biggest failures of our time to prevent air pollution.

Dr. S.K. Jindal has examined various air pollutants and their effects on the lungs.

### 13. WATER

When health workers in Rajasthan asked village women to name their single greatest need, they answered, "Water". That response would have been echoed throughout India and the

rest of underdeveloped world, where water supplies are not only insufficient but also impure, and often carry the microbes of such diseases as cholera, typhoid and amoebic dysentery. In rural areas, one well or water-hole may serve an entire community as well as cattle. Of the 250 million people living in the cities of Africa and Asia, only one in five has piped water in his home and fewer than half have water within half a mile. Where water lines have been laid, the effects on health have been immediate and dramatic in one rural section of India, the death rate from cholera fell by 74 per cent in five years.

Dr. G. Mahajan has given the report of his study on groundwater pollution and the associated hazards to health.

## 14. FOOD

Adulteration of food with chemicals of various kinds, to make a fast buck is widely known. But inadvertant contamination of the food-stuffs with microbes, parasites, residual pesticides and weedicides is not fully appreciated. Above all the fad of mixing food additives is a bane of modernization. The bread you eat daily or the soft drink you relish contain such substances as sodium propionate, sorbic acid, potassium bromate, phosphoric acid, citric acid and caramel colours. You might be wondering whether these ingredients are beneficial, or of no food value or potently harmful to health.

In the broadest sense the word "food additives" includes food colours which impart different colours and food preservatives which extend the storage life of food.

### 14.1 Natural vs. Synthetic

It is estimated that there are about 3,000 chemical substances which are added to food. Depending on their source, these substances may be classified as natural or artificial. Some of the natural additives are various gums like arabica, ghatti and karaya gums, colouring materials like saffron, turmeric, flavouring materials like lemon grass, rose and cinnamon oils. Artificial or synthetic food additives include phosphoric acid, saccharin and potassium metabisulphite. Bread, biscuits, cakes, confectionery jams, jellies, marmalades, ketchup, various soft

drinks, alcoholic drinks, tinned products, cheese, sweets, etc. are only a few of the long list of products containing additives.

#### 14.2 Improving Nutritive Value

Addition of iodine to common salt in the Himalayan region for reducing the incidence of goitre (swollen thyroid gland) in humans is a good example. Similarly bread (specially that manufactured by the organized sector) is enriched with several vitamins and minerals. Additives such as various vitamins are used to compensate for losses during processing. Often, vitamin C is added to fruit juices and vitamin A to skimmilk powder.

#### 14.3 A List of Common Food Additives is given below, alongwith the Areas of their Use :

Sl. No.	Group and function	Examples	Uses
1.	Acidity imparting agents	Acetic acid, citric acid, phosphoric acid.	Jams, Jellies, Soft Drinks
2.	Aerating or gas imparting agents	Carbon dioxide	Carbonated beverages
3.	Anti-caking and lump preventing agents	Calcium phos- phate, Starch	Table Salt
4.	Bleaching or colour reducing agents	Chlorine	Wheat flour
5.	Coating or surface glazing agents.	Bees wax, Paraffin	Chocolates
6.	Colour agents	Turmeric, Saffron	Soft Drinks, Confection- ery
7.	Emulsifying or oil dispersing agents	Derivatives of fatty acids	Chocolates, Ice-Creams

(Contd.)

Sl. No.	Group and function	Examples	Uses
8.	Flavouring agents	Essential oils	Soft Drinks, Chewing-gum, Confectionery
9.	Nutrients restoring nutritional value lost in processing	Amino-acids like lysine and various vitamins	Bread, Cereal products
10.	Preservatives preventing spoilage by micro-organisms	Sodium benzoate, Sorbic acid	Jams, Bread, Dressed Chicken
11.	Sweetening agents in place of sugar	Saccharin	Diabetic foods

Dr. R. Nath and his associates have looked at food from an entirely different angle, *i.e.*, Environmental impact of heavy metals on health. In another article Dr. Surjit Singh and Dr. Sunit Singhi have given their findings with respect to environmental lead pollution.

#### 14.4 Flavour

Flavour is a combination of taste, feeling and odour on receptors in the mouth and the nose. Traditionally, several ingredients were being added to food to improve the flavour. Flavouring materials are added to give the flavour or modify the particular flavour or to mask the original flavour. A good example for flavour is sugar in coffee. Flavouring is widely used in bakery products, confectionery and soft drinks. Concentrated fragrance is the essence.

#### 15. INFECTIOUS DISEASES

In the underdeveloped countries, infectious illnesses are a major threat. Their cost is high, not only in suffering, but in the permanent damage they can do. In some rural sections of

India, trachoma has weakened the vision of 80 to 90 per cent of the population; in some African villages, blindness is so common that ropes are strung to guide women on their way to the village well and bamboo poles laid to guide men planting in the fields. The first step in the control of many diseases is to find their carriers, e.g. flies and mosquitoes, etc. and then trace the paths by which they travel. These two activities are a major concern of medical research in the new nations.

Dr. Amod Gupta has described various environmental eye diseases, in his article.

## 16. TIME POLLUTION

The ease with which men jet from one time zone to another may also have undesirable effects on health due to environmental change and stress involved. An airline pilot who flies from New York to Tokyo is still on New York time, biologically speaking, when he arrives at his destination. It is several days before his pulse rate, body temperature, digestive processes and secretion of adrenal hormones adjust. After several such trips he may develop various unpleasant symptoms: he may lose or gain weight, and suffer from insomnia and a general sense of tension and irritability.

Mrs. S.A. Samuel has dealt with time pollution on a different wavelength. She justifies that time pollution is the worst of all. "Impure air and water can be re-used after it is subjected to purification but not the time which has passed."

## 17. STRESS ENVIRONMENT

Driving a car through heavy traffic, working at a frustrating job, watching a child struggle with illness, quarrelling with one's mate—the stresses of life take infinitely varied forms. And they can pose just as much of a challenge to health as bacteria, viruses, malnutrition, or chemical and physical forces.

Each man reacts in his own way. The family quarrel that triggers a heart attack in one may only make another resentful, while for a third it may even serve as a goad to useful and productive work. Whatever the response, it involves the whole

person; both body and mind play a part in dealing with the stresses of life.

The stress reactions have both physical and psychological aspects. The physical effects that result are dictated in part by the stimulus itself and in part by past experience. Everyone sneezes if sufficient plant pollen is introduced into his nasal passages—this universal physical response has the effect of eliminating the pollen from the body. But in some people this response is very much exaggerated. Because of their genetic endowment and the effects of previous exposures, these people are allergic. They find pollen so threatening that they overreact to it, throwing up a defence that produces all the symptoms of a disease—stuffed noses, itching eyes, sneezing, weeping.

Dr. Surrinder Kaur has dealt with a strange wild grass growing in and around Chandigarh, which is a potent skin allergen.

## 18. THE EDUCATION

In the underdeveloped countries, superstition, ignorance and fear are as much a threat to health as are the microbes of disease. In villages the centuries-old custom of rubbing the navels of the new-born with vegetable oil often results in death from tetanus. It could not be possible, if many primitive peoples were more afraid of the hypodermic needle than they were of disease.

Dr. R.C. Mahajan has emphasised on the importance of the environmental health education.

Similarly vaccination against poliomyelitis, diphtheria, tetanus, whooping cough, measles, mumps, rubella and rabies can prevent these dreadful diseases. This is possible only, if immunization education is widely disseminated and emulated.

Dr. D. Banerji, has cautioned on the possibility of over-immunization and the resultant disequilibrium in ecology.

## 19. THE HOSPITALS

Once upon a time, hospitals rarely had running water, and what water they had was usually contaminated. Garbage, human wastes and assorted offal were dumped into a pit in the

courtyard. Surgeons wiped their instruments on their trousers; bed-clothes were rarely changed. Hospital infection was rampant—upto one-third of all women giving birth died of puerperal fever, a form of blood sepsis. As late as mid-century only a few visionaries recognized any connection between filth and disease.

Unless people take the right precautions, hospitals still risk becoming breeding-grounds for disease. This was stated by Miss Nightingale, who was horrified by what she saw in the cholera and dysentery-infested hospitals. In her "Notes on Nursing," she wrote: "There are five essential points in securing the health: Pure air, Pure water, Efficient drainage, Cleanliness and Light." If by pure air and light she meant what today we call a good environment, she was saying just what WHO says today—that health is not just hospitals, doctors and drugs, but everything that we understand by "the quality of life" and the environment.

At Budapest's St. Rochus Hospital, Ignaz Semmelweis was given freedom to enforce his antiseptic practices in a ward assigned to him. Although the rest of the hospital remained typically dirty (and the incidence of hospital infection remained typically high), but in this ward fever and infections virtually disappeared among patients. This was a turning point, towards new era, in hospitals' environment, bringing cleanliness and freedom from infections.

Dr. C. Prakash has described various aspects of hospital environment in his article. Dr. D.B. Ray on the other hand has given a resume of community well being and conservation ethics in a project study, in another article.

## 20. WHO PROGRAMMES

During the last two decades, several WHO programmes were engaged in evaluating health hazards from various agents. High priority went to food additives, pesticide residues that might reach us through the food chain, the quality of drinking water, occupational exposure, air quality in the cities and the cancer risks from certain chemicals. Conference on the Human Environment, held in Stockholm in 1972, highlighted the need

for an expanded programme. While addressing this conference, Smt. Indira Gandhi, the then Prime Minister of India observed:

"Life is one and the world is one and all these questions are interlinked. The population explosion, poverty, ignorance and disease, the pollution of our surroundings, the stockpiling of nuclear weapons and biological and chemical agents of destruction are all parts of a vicious circle. Each is important and urgent. The extreme forms in which questions of population or environmental pollution are posed obscure the total view of political, economic and social situations. We believe that planned families will make for a healthier and more conscious population. But we know also that no programme of population control can be effective without education and without a visible rise in the standard of living. Our own programmes have succeeded in the urban or semi-urban areas. To the very poor, every child is an earner and a helper. We are experimenting with new approaches and the family planning programme is being combined with those of maternity and child welfare, nutrition and development in general."

WHO's new programme was initiated in 1973 and has four fundamental objectives:

- (a) to assess existing information on the relationship between exposure to environmental pollutants and man's health, and to provide guidelines setting the exposure limits consistent with health protection;
- (b) to identify new or potential pollutants;
- (c) to identify gaps in our knowledge about the health effects of agents likely to be increasingly used in industry, agriculture, in the home or elsewhere;
- (d) to encourage countries to harmonize their methods of assessing harmful factors so that the research results can be compared on an international scale.

Dr. S.L. Goel and Dr. R.K. Jain have described the administrative aspects at various levels concerning environmental health, in their article.

## CHAPTER 2

# *Administration of Environmental Health Programmes*

S.L. GOEL\* and R.K. JAIN\*\*

### 1. NATURE AND SCOPE OF ENVIRONMENTAL HEALTH PROGRAMME

#### 1.1 Meaning

Environmental health refers to the ecological balance that must exist between man and his environment in order to ensure his well-being. The deterioration of the human environment through the population explosion, pollution of air and water, and other disruptions of the ecological balance pose a major international health hazard and a serious challenge. Professor J. Logan, in a paper published in 'American Journal of Tropical Medicine' in 1960, was able to show that environmentally transmitted diseases were responsible for the sufferings of 500 million people every year particularly among infants and children.<sup>1</sup> The U.N. Secretary General's report on problem of the human environment sounds a similar ominous note : "If current trends continue, the failure of life on earth could be

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engendered and thus, it is urgent to focus world attention on these problems which threaten humanity in an environment that permits the realisation of the highest human aspirations.”<sup>2</sup>

### **1.2 Environment vis-a-vis Development**

The close relationship that exists between an unhealthy environment and the economic condition of a community was pin-pointed by a panel of experts which met in 1971 to discuss the environmental problems of the developing countries. “Poverty and the very lack of development,” these experts said, “constitute an essential environmental problem in the developing countries. They recommended sanitation, nutrition and widespread disease as prime targets in an effort to improve the environment of millions of people, and to lay the groundwork for their economic betterment.”<sup>3</sup>

### **1.3 Aspects of Environmental Health**

The environment can be defined as an aggregate of all the external conditions and influences affecting the life and development of an organism. Human environment means everything that is experienced by man and it is the total nature of this experience that determines the quality of life. According to Roggers, “the environment appears to possess two main avenues by which it may reach man and affect man’s health: it may act upon his body as a material agent or it may act upon his mind and emotions as non-material agent, although sooner or later this may very well produce a material effect.”<sup>4</sup> The effect of both is the pollution of environment. Prof. Samuel Healer, Professor of Public Health at the University of Brussels defines pollution as “the presence in the ambient environment of chemical, physical or biological factors capable of inducing disturbances in the normal physiology and functioning of human organs.”<sup>5</sup>

We can classify the environment factors impinging on the health of the people as follows:

- (a) Physical, Chemical and Biological factors.
- (b) Social, Economic and Cultural factors.

- (c) Ecological, Economic and Aesthetic factors.
- (d) Individual human system.

All these agents in the environment interact with one another and produce the favourable or unfavourable impact on the health of the people.

#### **1.4 Meaning and Role of Environmental Health Administration**

Environmental Sanitation Administration is an activity of diagnosing and controlling the environmental factors which exercise or may exercise a deleterious and unhealthy effect on the physical, social and mental life of the people the Draft Five-Year Plan (1978-83) has rightly mentioned : "The essence of sound environmental growth lies in a happy blend of the realisation of the physical outer limits to the exploitation of environmental resources and the inner limits to human needs and aspiration."<sup>6</sup> Environmental health administration is quite complex and complicated owing to the complexity and diversity of the socio-political and institutional arrangements in which the programmes are implemented and the complexity, multiplicity of the physical, biological, social and economic factors that they must take into account. The objective of the environmental sanitation administration is to plan thoroughly to change favourably the environment itself and modify the interaction of human beings with the environment so that the people can enjoy a good quality of life. The administration of environmental programme is not within the purview of any single discipline but presents a challenge to many disciplines. The administrators responsible for such programmes must plan to attack the unfavourable factors in concert with one another. We may mention some of the important areas which need the immediate attention of the planners, policy-makers and administrators to solve these impending problems—potable safe water supply and water pollution, solid wastes management, air pollution control, occupational health, food sanitation, urban planning and housing slum clearance, soil erosion, noise pollution, etc. The administration must define in the geographical context the magnitude of each problem, its

relationship with others and the benefits expected—direct outputs, intermediate effects or impacts and the ultimate effects or benefits. Some of these have been indicated in the form of a table (see Table 1). The administration of environmental health programmes are very expensive and complicated. In order to translate the benefits of such programmes to the society, the administrators must ensure that the programme:

- (a) receives acceptance and support;
- (b) achieves the desired objectives and results;
- (c) links its efforts with those of other health and socio-economic development programmes; and
- (d) accomplishes its work economically, with a minimum waste of money and other scarce resources.<sup>7</sup>

## **2. ORGANISATIONAL STRUCTURE AT THE GLOBAL AND THE NATIONAL LEVELS**

### **2.1 Global Level**

A series of World Health Assembly resolutions in the early 1970s and several specific recommendations emerging from the UN Conference on the Human Environment held at Stockholm in 1972, underlined the urgency and seriousness of this programme. Maurice F. Strong, Secretary General of the UN Conference on the "Human Environment", said at the opening of the discussion that "there could be no conflict between environment and development."<sup>8</sup> WHO's programme in this direction since 1973 has four fundamental objectives:

- (a) to assess existing information on the relationship between exposure to environmental pollutants and man's health and to provide guidelines setting the exposure limits consistent with health protection;
- (b) to identify new or potential pollutants;
- (c) to identify gaps in our knowledge about the health effects of agents likely to be increasingly used in industry, agriculture, in the home or elsewhere;
- (d) to encourage countries to harmonise their methods of assessing harmful factors so that the research results can be compared on an international scale.<sup>9</sup>

**Table 1 : Types of Output in Illustrative Environmental Health Programmes**

Programme	Direct Outputs	Intermediate Effects or Impacts	Ultimate Effects or Benefits
Water Supply	Safe water provided to households in adequate amounts and used efficiently	Reduced disease from water borne pathogens; support to hygiene, nutrition and economic activity.	Longer survival.
Water Pollution Control	Reduced contamination of (used water returned to) water-courses, seas, soil and food.	Improved water resources for human use; reduced damage to marine life; improved aesthetics.	Less disability, suffering, impairment and pain
Solid Wastes Management	Wastes confined, removed and disposed of (treated/recycled)	Reduced disease from vector-borne pathogens and from pathogens and chemicals transferred to air, water and land; economic gains; improved aesthetics.	More efficient personal and social performance
Air Pollution Control	Reduced introduction of toxic, irritant and nuisance elements into ambient air	Reduced death, disease and discomfort; reduced economic losses; improved aesthetics.	Improved quality of life
Occupational Health	Reduced physical/chemical hazards in work environment, through primary and secondary disease prevention services	Reduced illness, trauma and poisoning; safer work environment; improved working conditions and productivity.	Socio-economic development.

(Contd.)

**Table 1 (Contd.)**

<b>Programme</b>	<b>Direct Outputs</b>	<b>Intermediate Effects or Impacts</b>	<b>Ultimate Effects or Benefits</b>
Food Sanitation	Food safeguarded against contamination in production, processing, delivery, preparation and consumption.	Reduced disease and death from pathogens and toxins in food; enlarged markets; improved aesthetics.	

Source: Public Health Paper, No. 59, p. 113.

The Habitat Conference, held in Vancouver in 1976 stated as a goal, "fresh water for all by 1990." The UN Water Conference, at Mardel Plata, Argentina in 1977, designated the period 1981-90 as the International Water Supply and Sanitation Decade. Alma-Ata Conference (1978) on Primary Health Care spelt out in broad outline two-part strategy for health: more relevant health services and more emphasis on preventive health with allround social and economic development. The above survey indicates that the UN system and specialised agencies are helping to promote the research and co-ordination on various issues concerned with environmental sanitation. Let us now discuss the situation prevailing in India.

## 2.2 National Level

Article 48 of the Constitution of India specifies that the State shall endeavour to protect and improve the environment.

A National Committee on Environmental Planning and Coordination (NCEPC) was created in 1972.

The Committee is assisted by the Department of Science and Technology functioning as the technical secretariat. NCEPC's aims are to identify, investigate and propose solutions for the problems affecting the quality of life of the people in the context of population growth, economic development and technology utilisation. To accomplish this goal it reviews, formulates and promotes policies and programmes. There are a number of sub-committees constituted by NCEPC which include:

- (a) The Environmental Research Committee (ERC) has been set up to provide funds for study and research in the field of rural and urban settlement, resource management, environmental degradation and in the sector of non-formal education and training;
- (b) The Indian National Man and Bio-sphere Committee (MAB) promotes research on the ecological aspects of environment and operates as a part of the worldwide Man and Bio-sphere Programme of the UNESCO;
- (c) The Committee on Human Settlements is concerned with identifying and promoting research into the problems of development of our villages and cities;

- (d) The Committee on Industry and Environment promotes research in combating pollution of air, water and land arising from the process of industrialisation;
- (e) The Committee on Rural Environment focuses specifically on the intersectoral problems of rural development; and
- (f) The Committee on Nature and Natural Resource is interested in promoting research on the conservation of flora, fauna and other natural resources.

### **2.3 Functions of the Committee**

- (a) Appraisal of industrial projects from the environmental angle.
- (b) Issuing of guidelines for the setting up of projects.
- (c) Advising the concerned departments and authorities on the environmental implications of the proposed projects.
- (d) Providing inputs to regional development through the setting up of task forces.
- (e) Promoting research into environmental and ecological problems.

Under the Act of 1974 (Prevention and Control of Water Pollution) a Central Board and State Boards have been constituted. The Act of 1977 empowers these Boards to impose a cess on municipal authorities and specified industries. Wild Life (Protection) Act, 1972 has been enacted to protect the endangered species of flora and fauna.

Besides there are a number of bodies at the National and State levels which help in environmental health programmes indirectly:

- (a) Town and Country Planning Organisation (TCPO).
- (b) Housing and Urban Development Corporation (HUDCO).
- (c) National Building Organisation (NBO).
- (d) National Committee for Environmental Planning and Co-ordination (NCEPC).
- (e) Central Water and Power Board (CWPB).

(f) National Council for Science and Technology (NCST); in the State level there are :

- (i) The Departments of Town Planning and Regional Planning.
- (ii) Environmental or Planning Co-ordination Boards (or Agencies).
- (iii) Economic Planning Departments.
- (iv) State Housing Boards, Slum Clearance Boards, Power Boards, Water Supply and Drainage Boards, etc.
- (v) Special agencies such as Development Authorities.

We shall now concentrate only on one of the acute problems pertaining to environmental sanitation programme that is water supply and sewerage.

### 3. WATER SUPPLY AND SEWERAGE

Infectious diseases resulting from water pollution can be classified into four groups, depending upon the ways in which their incidence can be lessened by improvements in water supply:

- (a) "Water-borne" diseases are those in which infectious agent remains alive in drinking water e.g., typhoid, para-typhoid, gastro-enteritis, etc. The incidence of these diseases can be reduced by the purification of water.
- (b) "Water-washed" diseases include infection of the outer body surfaces e.g., trachoma, skin ulcers, scabies and typhus, bacillary and amoebic dysentery and gastro-enteritis. The incidence can be reduced by augmenting water quantity.
- (c) "Water-based" infections e.g., schistosomiasis, guinea worms. The infection occurs when the skin is in contact with water or through drinking water.
- (d) Water breeding or water proximity diseases are caused by mosquitoes or flies living near aquatic conditions.

There is probably no single factor that has a greater effect on the health, well-being and development of a community than the provision of ample and convenient supply of wholesome and good quality water. In towns and cities water supply is recognised as a basic necessity for industrial and commercial purposes; it is vital for the maintenance of public health and the prevention of epidemics. Dame Barbara Ward, President of the International Institute for Environment and Development, rightly observes that, "Water is everywhere the key to human health—clean water is a key to human comfort, health and even survival."<sup>10</sup> Martin Boyer, Adviser, Drinking Water Programme, UNICEF has observed that "The provision of ample supplies of safe water and the sanitary disposal of excreta have a direct and far-reaching effect upon the health and well-being of rural populations. Indeed, it is believed that no other single measure can make a comparable contribution to the improvement of their health and standard of living. The choice of an appropriate technology depends on local conditions."<sup>11</sup> To quote WHO: "One hospital bed out of four in the world is occupied by a patient who is ill because of polluted water. . . . Provisions of a safe and convenient water supply is the single most important activity that could be undertaken to improve the health of people living in rural areas of the developing world."

WHO estimates that as much as 80 per cent of all diseases in the world are associated with water. Iain Guest (Geneva), a specialist in development topics submits that an astonishing number of people suffer from these water related diseases at any time, 400 million with gastroenteritis, 160 million with malaria, 30 million with river blindness, 200 million with schistosomiasis.<sup>12</sup> At the 1969 World Health Assembly, a delegate from the region (SEA) estimated that water-borne diseases accounted for 40 per cent of all mortality and 60 per cent of all morbidity in his country.<sup>13</sup>

In India, as in nearly all developing countries, the provision of adequate, wholesome supplies of water and the sanitary collection, treatment and disposal of human wastes are prime needs in the national programme of social, economic and industrial development. In addition, the problems of water discharges, air-pollution and occupational hazards which

accompany industrial growth have to be solved if industrialization is to produce maximum benefit for the community.

India's needs are especially great because of its vast population. The Panel on Health (Planning Commission, Government of India, August 1960) reported that there were 62 million urban dwellers in 1951 of whom only 18 million were served by a water supply system and only 10 million by sewerage. Thus, we had inherited a poor sanitation arrangements at the time of independence. But the sad fact is that the conditions have not improved substantially even after a lapse of over four decades.<sup>14</sup>

The National Water Supply and Sanitation Programme was implemented in 1954 as part of the Health Plan to assist the States in their urban and rural water supply and sanitation facilities throughout the country. A Central Public Health and Environmental Engineering Organisation (CPHEEO) was set up in 1954 to provide technical advice and guidance to State governments in the preparation and execution of their schemes. The headquarters of the institute are at Nagpur on a spacious 109 acre plot and it has set up eight zonal laboratories to meet the requirements of different regions all over India. The institute handles a variety of research problems and investigations connected with water treatment and distribution, sewerage treatment and disposal of industrial waste, effluent treatment, instrumentation, air pollution control and industrial hygiene, rural sanitation and solid waste disposal. It also provides consultancy service to industries, municipal corporations and public bodies on the control of water and air pollution.<sup>15</sup> The institute has been helped to a great extent by the UNDP and WHO.

### **3.1 Rural Water Supply and Sanitation**

Till March 1978, 64,000 villages (covering 10 per cent of the rural population) have been provided safe drinking water. The real effort in this direction was made since the commencement of the Fourth Plan. In the Fifth Plan, the provision of water supply in different areas was included in the minimum needs programme. As in the Sixth Plan, the rural water supply continues to be a part of the Minimum Needs Programme as well as the revised 20-Point Programme during the Seventh Plan.

However, in order to achieve the maximum coverage of rural population during the Seventh Plan, the scope of rural water supply under MNP needs to be extended to all villages whereas it was restricted to identified problem villages until the end of the Sixth Plan. During the Sixth Plan period, there has been a quantum jump in investment in this sector, especially with regard to the provision of rural water supply. The priority given to this programme is clearly seen from the fact that the Central Government has given a big helping hand to the State governments in providing the problem villages with water supply by progressively increasing the central assistance under the Accelerated Rural Water Supply Programme (ARP). The amount under ARP and incentive schemes given to the States for the implementation of rural water supply programme in the Sixth Plan amounted to Rs. 918.65 crores and during the Seventh Plan, it is likely to be about 1.5 times that amount.

### **3.2 Urban Water Supply and Sewerage**

The situation in urban area is comparatively better. About 80 per cent of the population in the urban areas had been covered with water supplies programmes but many of these programmes need improvement and expansion to meet the needs of the growing urban population. Sewerage disposal is available only to 34 per cent of the urban population and that is too meagre. It was mentioned in the Draft Plan (1978-83) that, "The problem of collection and disposal of solid wastes has been on the increase in urban areas at an alarming rate, particularly in cities with large population. Concerted effort requires to be made to solve the problem. Suitable measures to regulate domestic and industrial effluents require immediate attention to prevent pollution of streams and rivers."<sup>16</sup>

Table 2 indicates that the population covered by rural water supply has increased from 162.07 million to 299.78 million i.e., 31% to 53.9% while in the case of urban water supply it has increased only from 115.48 million to 133.91 million. The conditions are very bad as far as the rural and urban sewerage is concerned.

A personal visit of the authors to the urban and rural areas of Haryana and Punjab revealed that about 20 per cent of the

**Table 2 : Physical Achievements Under the Sixth Plan**

Sub-sector	Population covered as on 31-3-1981	Population expected to be covered by 31-3-1985
1. Rural Water Supply	162.07 million (31.0%)	299.78 million (53.9%)
2. Urban Water Supply	115.48 million (77.8%)	133.91 million (81.1%)
3. Rural Sanitation	2.80 million (0.5%)	5.7 million (0.95%)
4. Urban Sanitation	40.03 million (27.0%)	57.27 million (33.0%)

Source: Seventh Five-Year Plan, 1985-90, Vol. II, p. 301.

total population in these areas have not the capacity to buy the services. This situation would not allow the total hygienic conditions prevail in these areas. It is suggested that the installations of water and sewerage connections may be provided by the Government to these people free of cost and more charges may be levied on those who have the capacity to pay. Thus, it is not only important to provide the water and sewerage facilities but also to see that such facilities are availed of by all to ensure complete environmental sanitation.

### 3.3 Finances

The expenditure on water supply and sewerage has been given in Table 3.

We can see from the Table that the investments in these programmes have been increasing but without parallel improvement as it is mostly capital intensive.

### 3.4 Central Board for the Prevention and Control of Water Pollution

Recognising the fact that water is such a scarce commodity, the Government of India enacted "The Water (Prevention and

**Tabel 3 : Expenditure on Water Supply and Sewerage**  
*(Rupees in crores)*

Scheme	1st Plan	2nd Plan	3rd Plan & 3rd Annual Plan	4th Plan	5th Plan (74-78)	6th Plan (80-85)	7th Plan (1985-90)
<b>1. Rural Water Supply</b>							
Rural Water Supply	3	30	48	194	347	918.65	1,378
<b>2. Urban Water Supply and Sewerage</b>	<b>8</b>	<b>84</b>	<b>174</b>	<b>380</b>	<b>403</b>	<b>614</b>	<b>1,236</b>
<b>Total</b>	<b>11</b>	<b>114</b>	<b>222</b>	<b>574</b>	<b>750</b>	<b>1,532.65</b>	<b>2,614</b>

Control of Pollution) Act, 1974" to provide for the prevention and control of water pollution and maintaining or restoring of wholesomeness of water. The Act provides for the creation of Central Water Pollution Control Board at the Centre and State Water Pollution Boards in each State for the purpose of implementing the provisions of the Act:

- (a) *Constitution* : The Central Board consists of a full time Chairman, five officers nominated by the Central Government to represent the Government, five persons nominated by the Central Government from among the members of the State Water Pollution Control Boards, 3 non-officials also nominated by the Central Government to represent the interest of agriculture, fisheries, industry or trade or any other interest, two persons to represent the companies of corporations owned, managed or controlled by the Central Government, and a full time Member-Secretary.
- (b) *Functions* : The Central Board has to carry out functions at two different levels:

- (i) as Central Board at the National level, and
- (ii) as State Board for the Union Territories.

At the National level, the Central Board's functions may be enumerated as under:

- (a) Advise the Central Government on any matter concerning the prevention and control of water pollution;
- (b) Co-ordinate the activities of the State Boards and resolve disputes among them;
- (c) Provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research, relating to problems of water pollution and prevention, control or abatement of water pollution;
- (d) Plan and organise the training of persons engaged or to be engaged in programme for the prevention, control or abatement of water pollution on such terms and conditions as the Central Board may specify;
- (e) Organise through mass media comprehensive programmes regarding the prevention and control of water pollution;
- (f) Collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control and prepare manuals, codes or guides relating to treatment and disposal of sewerage and trade effluents and disseminate information connected therewith;
- (g) Lay down, modify or annual, in consultation with the State government concerned, the standards for a stream or well;
- (h) Plan and cause to be executed a nation-wide programme for the prevention, control and abatement of water pollution;
- (i) Perform such other functions as may be prescribed.

As State Board for the Union Territories, the Central Board is to perform the following functions:

- (a) Advise the Government of Union Territories with respect to the location of any industry which is likely to pollute a stream or a well;
- (b) Lay down standards of treatment of sewerage and trade effluents;

- (c) Evolve efficient methods of disposal of sewerage and suitable trade effluent on land;
- (d) Develop economical and reliable method of treatment of sewerage and trade effluents;
- (e) Provide standards for the quality of receiving waters and for classification of water bodies and coastal waters; and
- (f) Inspect water and waste water treatment installations.

(c) *Objectives and Approach:* The Central Board intends to achieve the above objectives:

- (i) Control of pollution at the source to the maximum extent possible with due regard to techno-economic feasibility by prescribing Minimal National Standards for effluents at all situations and such strict standards as may be required in a particular situation;
- (ii) Utilisation of assimilative capacities to the natural waters to minimise investment in pollution control at sources;
- (iii) Maximisation of re-use/re-cycle of sewerage and trade effluents on land for irrigation and for industrial purposes after appropriate renovation;
- (iv) Minimisation of pollution control requirement by judicious location of new industries and re-allocation of existing industries wherever necessary;
- (v) Introduction of discipline in water extraction and discharges by classifying and zoning natural waters including coastal waters and through river flow regulation; and
- (vi) Upgrading water treatment works to ensure production of safe drinking water from the sources which are of doubtful quality.

An immediate objective set-forth by the Central Board is to prevent pollution of the drinking water sources in the country and to maintain them at the highest possible level of quality by enforcing suitable protective measures.

#### 4. CRITICAL ASSESSMENT AND SUGGESTIONS TO IMPROVE THE PROGRAMMES

The situation pertaining to environmental sanitation is horrifying at the global, regional and national levels. It has been admitted by the various agencies responsible for it at all levels. Attainment of the global target of the UN Second Development Decade (D.D2) did not seem feasible in most countries of the region. The Regional Director of the WHO in his Annual Report has warned the member-States:

In spite of the continuing efforts of governments and international and bilateral agencies, only the fringe of the problem has been tackled . . . there is an urgent need to mobilise further support from all available sources to solve this difficult problem. Investment in this field will be amply rewarded not only in terms of reduction in the incidence of communicable diseases, but also by substantially contributing towards an improvement in the standard of living.<sup>17</sup>

Dr. Abel Wolman, one of the "father-figures" of environmental health and Professor Emeritus of Sanitary Engineering at the Johns Hopkins School of Engineering, Baltimore, USA says while talking of the world health situation: "It always leads great conferences to pass resolutions to do something about providing water to impoverished people. Resolutions become opiates because they are gratifying substitutes for action."<sup>18</sup> He warns the policy-makers and administrators against complacence and says, "Viewed on a global basis, we have little to be sanguine about. The disease—consequences of poor and insufficient water, of living with human excreta, and of unhygienic personal habits, are disastrous—they have been familiar for so long a time that they no longer excite even the statistician or epidemiologist. People accept their devastation, as they so often objectly bear their real and spiritual poverty. We speak of the toll of deaths, due to environmental deficiencies in a casual way, even though the figures mount to hundreds of millions. The communicable diseases often the sequels of poor sanitation are maiming and killing men, women and children—not computer data."<sup>19</sup>

It is beyond doubt that a lasting solution to many of the existing and future problems of public health require control on environment. The question arises as how to provide sanitary facilities to hundreds of millions of people still without even minimum sanitary facilities? How to tackle such programmes? How to find the resources required for these programmes? What should be the administrative set-up to ensure speedy implementation? What are the responsibilities of planners and policy-makers to ensure integrated approach? We shall discuss the facts and suggestions to provide good environment for a healthy growth of the people.

#### **4.1 Need of Co-operation and Co-ordination Among Allied Programmes**

There is a close relationship between the environmental programmes and other programmes. In practice, this relationship is ignored by the planners and administrators of these programmes, e.g., a dam has to be constructed for irrigation and power purposes; its consequences on human health or soil salinity are ignored or underestimated. To remedy such unfortunate situations it is suggested that an 'integrated' approach may be adopted. It presumes an unprecedented, ungrudging co-operation between different services, as well as between various brands of natural scientists on the one hand and of social and human scientists on the other. We have to encourage such integrated approach to have full impact rather than peacemeal goals and approaches. It was mentioned in a WHO document that, "more effective administration requires that planners and managers take account of the full range of implications of their own programme goals and further, that they actively seek to participate as consultants and collaborators in the planning and execution of other community programmes that demonstratively or potentially interact with environmental health."<sup>20</sup>

UNESCO's MAB Programme (Man and the Bio-sphere Programme) co-ordinates various disciplines by mobilising applied research efforts all over the world on major man environment resources interactions. It relies on international

co-operation among governments and the participation of all specialists. A major UNESCO research programme is closely studying the effects of human interventions in the environment and man himself in all the major socio-economic systems. We can get benefit of such programmes.<sup>21</sup>

#### **4.2 Need of Improving Administrative Capability and Competence of the Persons Associated with These Programmes**

Environmental health programmes are administered by technically qualified people but such people lack administrative capability and capacity, i.e., the ability to achieve results. We have doctors, engineers, town planners, inspectors, nutritionists, geologists who are responsible for improving the environment. Every programme has its administrative component which is the heart and soul of that programme. It is suggested that the persons engaged on these programmes may be given suitable training in administration to enhance their competence.

#### **4.3 Need of Deploying More Resources**

The Environmental Health Improvement Programmes require considerable financial investment. The World Bank and WHO reported to the Mar Del Plata Conference that \$ 140,000 million would be needed to reach the target of clean water for all by 1990. Where will it come from? External aid is limited. So, there is a need to exploit the resources available within each country. It is only a question of proper allocation of resources. Voluntary effort can be encouraged to accelerate the pace of development. With exploitation of local self-help, money can be generated. It is also a question of political will. This programme must be made an integral part of the community development programme. It should take the form of self-aided programme. The funds allocated should be used to achieve the aims of the policy and care should be taken that the funds are not diverted for other purposes. It was mentioned by Dr. B.H. Dieterich, Director, Division of Environmental Health, WHO that "Development planners, confronted with meagre budgets, are often forced to keep some projects in

abeyance and give priority to others that may bring immediate economic benefit. It is now being increasingly realised that it is not a practicable or economically sound idea to defer environmental health projects. Planners are beginning to look at environmental health projects in the context of the ultimate socio-economic objectives of the development process.”<sup>22</sup>

#### **4.4 Need of Research to Meet the Requirements of Different Geographical Areas**

There are many potential health hazards. We know much about some of these hazards and little about many of them. We must encourage research in the experimental laboratory and epidemiology to pin-point the areas of ignorance. Secondly, national institutes should carry out research to develop models for adapting measures to reduce costs. They may also find simple disinfection and devices suited to rural needs. We may not adopt costly western models to supply safe water and sewerage disposal, e.g., the British Development Agency, Oxford has made a latrine which turns the human excreta into organic manure producing some 60,00,000 tons a year. In the Republic of Korea, human excreta is being exploited to produce methane gas. There is need to change the attitudes of experts so that they can design the machinery and equipment suitable and feasible in our countries.

#### **4.5 Need of Local Participation**

Public administration is manned by and meant for human beings. It is, therefore, necessary to associate the people with the programmes of water supply and rural sanitary latrines. Sociologists, behavioural scientists and public relations experts should be associated with programmes to make the local involvement more effective.

#### **4.6 Need of Strong Political will and Determination**

It has been mentioned that the programmes of environmental health are deferred because of the lack of resources or the apathy on the part of the people. This assumption is totally

wrong and baseless. "The major cause for delinquent action lies in the motivation of governments. Do they really mean what their resolutions say—militantly enough to go into action? Is only lip service the main response of Presidents, Prime Ministers, Kings and Ministers? The task for the future is difficult but possible. People should not be consigned to premature death simply because we are less than courageous and diligent. The pace must be accelerated."<sup>23</sup>

#### **4.7 Need of Effective Maintenance**

It is not only important to build the infrastructure for the environmental sanitation programmes but also to see that these projects function efficiently and regularly. We must ensure their competent construction, efficient and fool-proof operation and maintenance of completed supplies and effective surveillance or quality of drinking water. The maintenance is very poor in the developing countries. Even in the planned cities like Chandigarh—the headquarters of three governments—we are shocked to find germs, mosquitoes and flies coming in the tap water. Besides, the dirt is scattered in the whole of the city. Thus, there is a need to maintain the services once provided to the people through efficient and economical administration involving the people.

#### **4.8 Need of Guidance and Assistance from Bilateral and Multilateral Agencies**

The capacity of the developing countries to solve the problem pertaining to environmental sanitation programmes are limited. International and bilateral agencies should be encouraged to increase their direct technical assistance to member-countries in the following ways:

- (a) In making assessment studies;
- (b) In the establishment of information systems and programme formulation, implementation and evaluation;
- (c) In identifying and helping to meet specific needs for multilateral or bilateral assistance by way of expertise, equipment, materials and soft loans;

- (d) In setting up research and training centres and collaborating laboratories;
- (e) In assisting training programmes, including programmes for the production of manuals and training guides;
- (f) In establishing health criteria and codes of practice; and
- (g) In the local production of materials.

In addition to providing assistance itself, WHO should act in a coordinating capacity in respect of assistance received from these and other sources.<sup>24</sup>

#### **4.9 Need of Civic Consciousness**

Environmental sanitation cannot be achieved by the effort of the Government alone. It requires the active support and co-operation of the people. It was indicated to the writer by the authorities responsible for water supply that 25 per cent of the resources are being wasted because the people do not care to use the services only when in need. Most of the public and private taps remain working without any utility. Besides, the people lack civic consciousness and they do not cooperate in the maintenance of hygienic conditions. One is shocked to see the beautiful city of Chandigarh with heaps of debris all round. The difficult task of improving environmental sanitation is possible only if the people develop civic consciousness.

#### **4.10 Need of Environmental Education**

The Stockholm Conference held in 1972 drew the urgency of tackling environmental problems through various efforts. One recommendation of this conference called for development of 'environmental education' as one of the most important steps to attack world's environmental crisis. The conference pleaded that "new environmental education must be broad-based and strongly related to the basic principles outlined in the United Nations Declaration on the New International Economic Order." Environmental education has been defined as an educational process dealing with men's relationship with his natural and man-made surroundings, and encompass the

relation of population, health, pollution technology, urban and rural planning, housing, proper nutrition to the total human environment. The scope of environmental education is vast, touching every aspect of man and environment. The purpose of environmental education is to provide knowledge to the people so that they can adjust with the environment and enjoy decent environment. The goals of environmental education as discussed in the Inter-Governmental Conference on Environmental Education, organised by the UNESCO in co-operation with UNEP, at Tbilisi (USSR), from October 14-26, 1977, are mentioned below:

- (a) To foster clear awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas;
- (b) To provide every person with opportunity to acquire the knowledge, value, attitudes, commitment and skills needed to protect and improve the environment; and
- (c) To create new patterns of individuals, groups and society as a whole towards the environment.

The Secretary General of the UN in his report on Population, Resources and Environment sums up the benefits of environmental improvement programmes. He mentions four social and economic benefits that would result from government action for environmental betterment in the poor countries besides the improvements in the people's health from control of infectious diseases:

- (a) Employment of large number of poor people in public works projects;
- (b) Reduction of food requirements and costs by lessening the mal-absorption caused by intestinal parasites. This might ultimately save \$ 2,000 million per annum in India alone. This annual saving would be equal to the entire capital cost of needed water supply improvements in the whole of rural India;
- (c) Increases in potential economic productivity through improved health of adults.
- (d) Greater receptivity of children at the early ages by improvements in health.<sup>25</sup>

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## CHAPTER 3

# *Hospital as Social Environment*

C. PRAKASH\*

The environment can be defined as "the aggregate of all external conditions and influences, affecting the life and development of an organism, human behaviour or Society." Four broad categories of environment influence the human behaviour namely, physical chemical, biological and social environments.

The hospitals are viewed as "Community Centres" and are important social environment in the larger eco-system : which is a complex web interlinking animals, plants, air, water and every other life form on this "biosphere". Human society and the natural world are two entities which interact with each other. But increasingly the trend has been of human action upon rather than adaption to the natural world. The natural world for analytical purposes is called the "biosphere" and the creation of humans as the "Technosphere". The suppression of biosphere by technosphere, in recent years, has been unparalleled in scale and pace.

Evolving man has passed through three phases. The first was strictly biological and during this phase human beings acquired the basic habits of dealing with one another which still govern the behaviour of the individuals, communities and nations. The second phase was the beginning of cultural

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development like domestication of animals, huntins, art and crafts, religious practices and seeking of new things. The third phase began with neolithic man and in the last 10,000 years gradually, acquired all the qualities and culture of modern civilization and inventions. Health and hospitals as a part of cultural development appeared as a great activity. Hospitals were seen as centre of great activity in culture transmission. At the end of this phase man developed the capacity to destroy himself by inventing the nuclear device.

The hospitals also underwent evolutionary changes. These are no longer viewed as "Cure Centre" but are community centres for comprehensive health care, attending not only sick, diseased, disabled, but attend to the need of healthy ones as well. Adoptions of community and families for better health and quality life has become the goal. There are thus varieties of hospital influences which impinge heavily on the behaviour pattern of individuals, families and communities.

The hospitals as a part of the social organization intended to meet the medico-social needs of the community has been obliged to adjust its facilities to the present requirements of the society. The most outstanding event has been the new approach by which the hospital should no longer live in isolation but open its doors to the community and adjust its functions.

There are many occasions and contact points between people and the hospitals. This can be judged from the numbers of patients coming to seek care from inpatient departments. As many as 4 lakh sought services from M.C.H., Rohtak. 35,000 were admitted during the year 1985-86. This does not include the attendants of clients visiting the hospitals for other reasons.

Hospitals and Health Centres are developing new culture to bring into their ambit by developing the information, education and communication system for those who are quite healthy and come to hospital for various reasons. The hospital environments has gone a tremendous evolution in this respect. The hospital health education booth, social medical units, speciality clinics and O.P.D. Clinics have in-built components of education of the clients on need basis. The index case becomes the focus and through that index case the message reaches the family and community. This is to me is a silent revolution, poised for

transformation of society by acculturation movement of hospital and health centres.

The hospital offers one of the best opportunities for learning about health. It is a veritable community centre. Patient enters a hospital with a health problem, their goal is to get well, hence they are motivated from within—a factor which creates a climate favourable to learning. The patient, his relatives and community leaders come in close contact with the physicians, nurses, medical social workers, technician and service staff. Thus hospitals enrich the capabilities of individuals, make them self-reliant on health matters and expect him to become a message giver in the community. He becomes familiar with hospital environments and develops his perception and probably communicate the same to his/her peer groups and the community. Some develop indelible impression, some adopt healthier practices for better and healthier living. Hospitals/health centres are thus non-formal health education institutions, having strong influence on the behaviour of individuals. Modern ways of communications like audio-visuals—films and televisions and exhibitions are being used increasingly to present the common problems, national programmes and diseases of prevalence. M.C.H., Rohtak attempts to reach common man through forums organized by Rotaries, I.M.A. and other non-government organizations. Experts and specialists of this hospital are used as resource persons to build a favourable climate for healthier living at community level.

The patient brings his environment, culture and habits to hospital in a variety of ways. The clients and patients have different dietary pattern, cooking practices, eating habits, their likes and dislikes and have their own perceptions about diets, their nutritive values, and many beliefs are held about different food items. The hospital staff is able to pick up these beliefs, and accordingly there have been some attempts to modify the hospital diets suiting to the needs of the clients. Concurrently there are opportunities to raise the level of understanding, developing right kind of perception and nutritive values of different food items, dispelling wrong beliefs in relation to food items. Promotion of breast feeding, right kind of weaning foods, nutritional needs of young children, hypertensives, nephrotics, cardiac cases, obese, anaemic mothers and healthy

adults are some of the areas where hospitals and health centres can play their effective role to change the behaviour pattern of the community. Various dietary risk factors have been incriminated in the development chronic diseases which can be explained to the people.

The hospital environments are considered to be model environments for adoption. All hospitals strive for cleanliness and environment free from dirt, dust, mosquitoes, flies, insects, rodents, etc. Better ventilation and illumination brings in sense of aesthetics and better exchange of air. These are the demonstration areas which get printed on the mind of patients and attendants. These impressions are carried back to their environments. People learn the environments conducive for good health and may adopt some of these in their own settings. Personal hygienic practices could be most appealing, which can be adopted without incurring any extra cost or expenditure. The hospitals can promote this practice universally and can liberate the individuals from many diseases like Worm Infestations and Diarrhoeas. Use of safe drinking water can be inculcated in hospital settings to get rid of dreaded diseases. Some of the simpler technologies can be propagated to do away the menace of house flies and mosquitoes in their local situation. Biogas technologies, smokeless *chullahas* and energy from non-conventional sources can be popularized on health grounds. Adoption of these practices in large scale can bring a balance in eco-system.

Some of the hospital environments travel with the patient to the community, which can be dangerous from the viewpoint of their implications. Hospital resistant infections if spread by patients to other community members can acquire a dangerous proportion. Cross infections is yet another problem, but all these are surmountable by modern appropriate techniques.

The community environments affect the hospital environments. If there are dangerous pollution zones in the vicinity of hospital like the thermal plants or industries or great rush of automobiles it can pollute the environments and the hospitalized clients are much more susceptible to the ill effects of such pollutions. There can be menace of mosquitoes, if there are breeding places in the vicinity. Unplanned developments, open sewerage system, human and animal excreta and industrial

affluents can affect the environments badly. Fly breeding and mosquito breeding in the vicinity can itself be constant threat of transmission of diseases apart from their nuisance value. Similarly uncontrolled human traffics, visiting hospitals can alter the environments, they can spread the infections can be victim themselves for certain infections. This needs to be controlled to safe limits by way of education. Thus hospital environments are susceptible to community environments and *vice versa*. This needs a coordinated efforts of municipal, urban authorities and hospital authorities to make the environments conducive for healthy living. All hospitals should strive for good incineration facilities, to dispose the hospital waste safely so that it does not become dangerous to the nearby communities. Similarly syringe services should be safe to avoid the transmission of dreadful disease like AIDS and others.

Extension approach of the hospital, by adopting geographical area and communities and linkages with its members and local self-government can influence the social environments in these settings, and can usher in better quality of life. Outreach approaches by different specialities can influence the mother groups, school children, adult population, young farmers and decision makers in the community. In the hospital and health centre institution, non-formal educational efforts can culminate to new environments—a healthy environment in the homes, work-places, farms, schools and universities. Voluntary bodies, non-government organizations, professional bodies (IMA), mass-media, NSS youths can be involved meaningfully to disseminate the information for better environments.

## CHAPTER 4

# *Environmental Impact of Slums on Health*

M. KUMAR\* and R. KUMAR\*\*

### 1. INTRODUCTION

Slum is an area of poverty, transition and decadence; a disorganized area occupied by human derelicts; a catch all for the criminal, for the defective, the down and out (Gist and Halbert, 1956). It has been variously described as cancer on the body of a city, a veritable hell and 'the utmost form of human degradation' (Nehru). Crime, vice, disease and illiteracy consistently show higher evidence in such surrounding (Shiv Mangal Suman, 1982). There is abundant starvation, malnutrition of children, women and the old, unemployment and under-employment, exploitation, torture, delinquency, depression, and other behavioural disorders, alcoholism, desertion, immorality, diseases and heinous crimes. These are devoid of food, sanitation, water, electricity, light, privacy, quietude, protection against diseases, health, medical care and above all any hope.

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### 1.1 What is a Slum

Slums are pockets of poor houses, poor people and poor environment, either in the middle of or at the periphery of a big city. Dirt, filth and stink fill the whole terrain. In one room (hovel/shack) the human beings of three generations are huddled together like sardines. The same room is used for cooking, co-habitation and breeding. There are hardly any belongings, utensils, foodgrains or clothes. The area of health and welfare is conspicuous by its absence.

### 1.2 Why the Slums Should Grow?

Growth of slums in the cities is a consequence of several complex factors. It is mainly the lack of planning and inability to cope with the needs of habitat to those, who build our houses and run our factories. Growth of industrial slums, overcrowding, pollution, degraded physical and social environments are some of the gifts of our modern civilizations (Jaiparkash Narain).

Some of the factors which lead to formation of slums are given below :

(a) *Migration* : Migration of rural masses, specially the unemployed and unskilled rural youth to the cities, either in search of work, easy money or glamour and the consequent poverty and hardship.

(b) *Low Income* : Most of the workers working in factories, commercial establishments, self-employed on petty jobs, have low and temporary income. They cannot dream of a modern house in a city like Bombay, Delhi, Calcutta or Chandigarh. Their options are either to commute to adjoining villages, sleep on *patris* (footpath) or settle in slum colonies.

(c) *High Cost* : The cost of land/building/houses in the cities is so high, that even citizens from middle income group are often found to live in slums, else they have to spend most of their earnings to get a small house on rent.

(d) *Shortage of Houses* : The construction activity has not kept pace with the ever increasing needs of housing. Even if some of the well-to-do workers are willing to spend a good part of their wages for renting a house, they don't succeed due to

shortage of houses. Hence a large number of new huts keep on springing up.

(e) *Unplanned Growth* : In the old areas of cities, lack of planning/layout/bye-laws or consideration to improve environment is missing. Dwelling units continue to be built wherever any space is available in disregard to ventilation, lighting, sanitation or passage.

(f) *Illiteracy and Unbridled Breeding* : The only thing a young illiterate couple may get at the time of marriage may be unemployment, starvation, malnutrition and poverty, yet they do not put any restriction in their reproductive area. The starving parents produce a starving child every year, who may either die or survive to lead a life of hunger, want and hopelessness. This in turn leads to ill health for the mother and increased stress on the society. Illiteracy worsens the scene further.

(g) *Exploitation* : Some self seekers with the support of politicians and bureaucrats, exploit the poor slum dwellers by charging rent even for the slum hut or *patri*, without providing any facility. These leaders of vested interest exploit the religion and other sentiments also, whenever government and voluntary agencies try to awaken the conscious of slum citizens or tend to provide some facilities in a planned area elsewhere.

(h) *Lack of Political Will* : There is no denial to the fact that enormous amount of funds are required to rehabilitate them but it also appears that various political parties have their vested interests in keeping the slums intact. Often the politicians, including those in power, pay lip sympathy to the cause of slum dwellers. Also they hold out tall promises, which become taller and louder just before the elections. In the process several *ad hoc* programmes and projects are announced and even inaugurated. However, as the din of election settles, the projects also vanish, before the ink is dry on the sanctions. After the elections are over 'paucity of funds' comes handy to put off these poorest of the poor.

(i) *Habits and Concepts* : Over a period of time, some persons who could build houses in a good locality, prefer to reside in slums, for so-called 'austere and miserly' living. Such people describe, all expenditure on good living, as a waste of money. Old habits die hard. They refuse to get educated or enlightened.

### 1.3 Magnitude of the Problem

Cities with a population of less than 30,000 have a migrant population of 30-40 %, whereas the component of migrants in cities of ten lakhs and above is over 50 %. In big cities the proportion of migrant population to total population in 1961 was 64.2 in Bombay, 59.9 in Delhi, 52.7 in Calcutta and 50.8 in Ahmedabad (J.C. Mehta, 1977). Even in the city beautiful—Chandigarh, despite meticulous planning and strict controls, the *Jhuggi/Jhompri* colonies have sprung up in various outer areas and their population is over 10%. In a recent study of squatter settlement in Delhi, it was revealed that more than 5 lakhs people live in 1373 clusters of slum-dwellers. Such population is growing at the annual rate of 12%.

According to another survey conducted in 1971, the city of Madras had 1202 slums, where 7.5 lakhs out of a 25 lakhs or more than one-third lived in these areas. In Calcutta 25 lakhs of people are living in slums. In a survey carried out in Ahmedabad in 1976, it was found that 81,255 families with 4,15,103 members were residing in about 700 slums all over the city. According to an estimate a few years ago about 20 lakhs people lived in slums in Bombay alone. A depressing thought is that by the year 2000 A.D., 70% of Bombay's projected population of 1.30 crores will be living in sub-standard conditions. Incidentally 2000 A.D. is the year, when WHO intends to provide health for all.

On an average over one-fifth of the total urban population is that of slum dwellers. However, the growth of slum population is 2-3 times more than the average growth of the entire urban population.

### 1.4 Slum Environment

The slum environment is conducive to spread of several ailments, viz., communicable diseases, malnutrition, mental and physical retardation and behavioural problems. In this race of unhealth, the children, women and the old are specially the winners. The victims of slum environment are no more fortunate than that of natural disasters, viz., floods, fire, famine, epidemics or terrorism. But these human beings get much less sympathy or support than the others, because slum environment is a slow,

almost insidious poisoning and it does not cause ripples in the conscious of political and other managers. However, the end result and consequences for the target groups are nearly the same in two situations. However, when the human environment is so constantly degraded, political instability caused by the presence of unassimilated settlers in large urban centres contains the seed of violent political frustration, and social unrest. Social and psychological behaviour is determined by conflicts between ethnic and social groups as well as between generations. Such is the usual picture of physical environment and the social setting of slum urban centres in India and other developing countries.

## 2. DEMOGRAPHIC TRENDS

Over-population is an important cause of slum formation. Let us study some facts about population in order to look at the slums in the right perspective.

India's population has grown from 273 millions in 1931 to 685 millions in 1981 and 746 millions in 1984. This increase has occurred despite the fact that crude birth rate has declined from 36.6 in 1972 to 33.3 in 1978 and total fertility rate from 6.7 births per currently married women in 1972 to 5.3 per such woman in 1978. Major reasons cited for the steady growth of population are lower age of marriage, high infant mortality, low rate of illiteracy, low per capita income, slow pace of the family planning measures and inadequate coverage of MCH services. According to a UNICEF report in 1985 in one-third of India's districts the mean age of marriage of woman is still below 15 years. Literacy is another important factor to bring awareness about the importance of small families. The female population is only 25% literate as compared to literacy rate of India; 36% in 1981. Kerala with highest literacy rate of 70.79 % among adult females and 85.98% among adult males, the birth rate was the lowest in the country, i.e., 25.7 per thousand in 1979-80, whereas the birth rate was the highest in U.P., where literacy rate is low.

Similarly, the correlation between female literacy and infant mortality is at once clear. According to one report infant mortality in 1978 among the illiterate mothers in rural

and urban areas was 145 and 88, respectively, whereas it was 101 and 57, respectively for married women, with educated status of below primary level. The figures were 71 and 41 for educational status above primary level. The rate in developed country is 10-30 per thousand. In the present socio-economic condition in India, the goal of reduction of infant mortality, to 60 per thousand is desirable, as also essential to persuade a mother that health of both herself and her child will be better if the births are fewer. Looking at the fertility control programme; we have to raise the coverage of protected couples from the present level of 25.9 % (1982-83) to the level of developed countries, i.e., at least 60%. Our aim is to achieve zero growth rate by A.D. 2000. This entails reducing the present birth rate of 33 per thousand to 21 per thousand population. Also the total marital fertility rate is to be brought down to 2 from the present 5.3 births per married women.

The necessary enthusiasm and drive to achieve the goal of small family norm will come, with emphasis on ante-natal care, immunization of mothers and children, prophylaxis against nutritional anaemia and blindness; besides raising the age of marriage, improved literacy and better coverage of the couples of fertile age groups.

### 3. HEALTH AND WELFARE

Health is a component of what is known as welfare. Government of India declared that in our welfare State, there will be no place for the five giants—Poverty, Disease, Ignorance, Squalor and Idleness. Welfare means a 'level of living', which is identified by per capita income. An expert committee of U.N. mentioned nine factors as the components of living; health, nutrition, housing, education, employment and working conditions, clothing, social security, recreation and human rights. Health comes first and is first of all. And health is not merely an absence of disease, it means well-being, physical, mental, social, spiritual, etc. While health is important for all, the child, the mother and the old constitute priority groups. In the slum areas the health and welfare both are missing.

#### 1.3 MCH

In India women of the child bearing age constitute 22% and

the children under 15 years of age 42% of the total population. This group is not only the largest, but is also most vulnerable to health risks, especially in slum areas, whereas 50% of all deaths in the developed world are occurring in the old age group (over 70), the same proportion of deaths are occurring among children in the developing countries, during the first five years of life.

### **3.1.1 Mother and Child one Unit**

A child is completely dependent on mother for physical, mental and social development, right from the day of conception. If mother is not in good health or dies, the child is also doomed. Hence the current trend is to provide integrated MCH services to the community *i.e.* outside the four walls of hospitals. The aim is to provide positive health and not merely to treat disease. The slums require MCH services the most.

For description purposes, the development of mothers, infants and young children may be divided into several periods. The development periods are schematically presented in a figure below:

Labour and Delivery			
Maternal periods	Pre-pregnant or Pre-natal	Puer-Perium	
Fetal and Child Periods	Early Fetal	Pre-natal	
		Late fetal	Neo fetal
		In-fancy	Pre-school
Conception	20 weeks	birth (40 weeks)	
	20 days		
	6 weeks	1 year	
		5 years	
Principal periods of development			

Source : Mehta, *Habitat*, 1977.

### *3.1.2 Social and Preventive Medicine for the Mother*

The care of the maternity is largely a preventive medicine. The environmental factors which influence the human reproduction are many, *viz.*, age at marriage, child bearing, child spacing, family size, fertility patterns, level of education, economic status, customs and beliefs, role of women in society, etc. the most direct causes of maternal deaths include toxalmia of pregnancy, abortion, sepsis, exhaustion, severe malnutrition, etc.

### *3.1.3 The Social Value Attached to the Maternal Role*

Maternal mortality accounts for the largest or near largest proportion of deaths among women of reproductive age in most of the developing world, although its importance is not always evident from official statistics. In areas of slums where the problem is most severe, most maternal deaths simply go unrecorded.

From indicators, one can have a rough guess that some 500,000 women die of pregnancy related causes each year, most of them preventable. Maternal mortality rates in countries where the problem is most acute are as much as 200 times higher than the lowest rates in industrial countries. The tragedy is not only the women's untimely deaths but the consequences for the family, she leaves behind.

Considering that the value society attaches to the women's maternal role is one of the crucial factors influencing the status of women. How can we say that a high value is attributed to a woman if she dies needlessly in child-birth? If her child is born too small to survive the first week because her nutrition was so poor and her workload so great during pregnancy? If she is unable to breast-feed because she cannot devote enough time or leave her job? If she is not given access to effective, safe and acceptable methods to regulate her fertility? If she is bypassed by education and technological advances and isolated from the main-stream of community action, while she is trying to prepare her children for healthy, productive lives in the community? In short, how do we assess the social value accorded to reproduction and nurturing if women are denied the support needed

to carry out those roles? Is there any value of the life, let alone the quality of life, in the slums?

### *3.1.4 Social Paediatrics*

It is the application of the principles of social medicine to child care to prevent and treat disease and promote their adequate growth and development through an organized health structure. It is also concerned with the ante-natal care, which includes measures such as ensuring adequate nutrition of mother, prevention of communicable diseases, education of the mother for delivery, preparing for breast feeding and mother-craft, medical care of the child soon after birth, nutrition, immunization, accident prevention, psychological development and to meet the total health needs of a child, i.e. (a) healthy and happy parents, (b) a clean and healthful house, (c) a balanced and nutritious diet, (d) educational needs and (e) all round development i.e., play and amusement, love, affection and security, recognition, recreation, socialization with children. For the above health and welfare measures, the community can be reached through MCH, ICDS, CBD, etc.

### *3.1.5 MCH Problems*

In developing countries like India, and specially in the areas of slums the primary concern is reduction in the death rate of child and mother. This requires spacing of pregnancy, limitation of family size, immunization, improvement of nutrition and sanitation and to provide health education.

Infections of various kinds can lead to a variety of problems, retardation in foetal growth, low birth weight, embroyopathy, abortion and sepsis. In the set up of slums, where hygiene is very poor and health awareness non-existent, the incidence of maternal infections is high. Besides infection with viruses and toxoplasma, the incidence of urinary infection in the slums (and rural set up) is over 25%. Similarly the incidence of infections like diarrhoea, respiratory infections and skin infections is very high among the small children. Prevention and treatments of infections among the mothers and children is an important part of MCH care.

### **3.1.6 MCH Care Package**

It is a strategy to achieve a greater impact of MCH services on the health of mothers and children by providing integrated measures to tackle the problems of malnutrition, infection and excessive reproduction. The package count of ante-natal care, intra-natal care, post-natal care, nutritional health immunization, primary health care, family planning, etc.

The ultimate objective of MCH services is not only to reduce mortality and morbidity, but also to reduce the incidence of violence, crime, drug-taking, alcoholism, inadequacy and neglected and unwanted children.

## **3.2 The Child Care**

Ministry of Social Welfare introduced integrated child development services scheme (ICDS) in 1975 to give special coverage to slums in urban areas, besides the rural and tribal projects.

This scheme also envisages delivery of an integrated package of services consisting of supplementary nutrition, immunization health check-ups, nutrition and health education, pre-school education and refreshment services to the child below six and pregnant women and nursing mothers.

### **3.2.1 The Child and Mother at Risk**

The concept of identifying mothers and children who are considered to be at high risk has been adopted under this scheme. The following criteria have been laid :

The children at risk are those, (a) weight below 50% of the expected weight, (b) no breast feeding, bottle feeding, delay in supplying weaning foods, (c) failure to gain weight in 3 successive months, (d) birth weight of less than 1.5 kg., (e) twin births, (f) history of death of more than 2 siblings below the age of 12 months, (g) death of either parents, (h) severe acute infection like measles or whooping cough, (i) birth order 4 or more, (j) spacing of children is less than 2 years, (k) only child for a long married life and (l) upper mid-arm circumference, less than 13.5 cm (for 1-4 years).

The mothers at risk are those (a) the pregnancy weight is 38 kg, or, (b) weight of mother 40 kg or less of 20th week of pregnancy, (c) failure to add 1 kg per month to 40 kg, after 20th week of pregnancy, (d) height of 145 cm or below, (e) primipara, (f), twin pregnancy, (g) history of early neonatal deaths, (h) history of still births, abortions, ante-natal and post-natal, eclampsia, (i) history of previous forceps delivery or caesarian, (j) age below 18 or above 35, (k) conception after a long infertility, (l) suffering from TB, severe anaemia, heart disease or diabetes and (m) had 4 or more pregnancies.

### **3.2.2 Guidelines**

Guidelines on child care education as advised by Government of India are given below :

#### **I. Basic Messages**

1. Breast feed as long as possible.
2. Introduce semi-solid food at five to six months.
3. Feed young children three to six times a day.
4. Don't reduce food in illness.
5. Use the available health services.
6. Get children immunized.
7. Keep yourself and your surroundings clean; drink clean water.
8. Have not more than two—children, two to three years apart.

#### **II. Components**

##### **1. Pregnant Mother**

- (a) eat more than usual amount of cereal and pulse, and plenty of dark green and yellow vegetables and fruits;
- (b) visit PHC doctor/ANM during last three months of pregnancy.

**2. New baby**

- (a) mother's milk is best; don't discard colostrum;
- (b) if you feed additional liquids, use a clean traditional feeding vessel or a spoon.

**3. Keep on breast**

feeding as long as possible, but this is not sufficient by itself after the age of five to six months.

**4. Mother's breast feeding child**

- (a) mother should eat more than usual amount of cereal and pulse, and plenty of dark green and yellow vegetables and fruits;
- (b) visit the doctor/ANM for check-up.

5. Start semi-solid food (local, staple or mashed ready-to-eat foods) after five to six months and also undiluted cow's milk if you can. Those foods must be prepared carefully.

6. As the child grows, amount and variety of foods should be increased. By the time he is one year old he should be fed similar foods as are given to the rest of the family, such as cereal, pulse, green vegetables, perhaps supplemented by processed ready-to-eat foods. But in order to get as much as he needs he should be fed these solid foods three or four times a day.

7. When you are unable to feed the child with your own milk, solid food (which may include supplementary ready-to-eat foods) should be given five or six times a day. Also, if possible, undiluted cow's or buffalo's milk or Milkstone. (Milkstone is 50 per cent milk and 50 per cent milk extracted from vegetable sources).

8. Do not use excessive water for cooking rice and vegetables. If you drain the water after cooking do not discard it. It is good for you and should be consumed.

9. To prevent the child from getting some diseases he should be immunized. This will probably make him a

- little ill, but will prevent him from getting terrible scars later and perhaps dying.
10. To prevent him from getting other diseases he should be kept clean and his surroundings should be as clean as possible. Don't spit or cough at or near him.
  11. Do not let excreta lie around where your baby may be playing. Remove it quickly to a place outside his reach. After baby defecates wash him clean with soap and wash your hands. Your child may get sick if he puts dirty hands in his mouth.
  12. Hands should be washed before eating and before preparing food and before holding and feeding the baby.
  13. Kitchen and feeding utensils should be kept clean and not allowed to attract flies. Flies means dirt and dirt means danger.
  14. Food should be kept covered from flies and dust.
  15. Only the safest available water should be drunk. A child needs plenty of water.
  16. Learn to recognize signs of common diseases : Cough, diarrhoea, dehydration fever, running ear, skin diseases, sore eyes, and poor sight. Learn their management and how to deal with accidents in the home and when to seek advice from ANM/doctor.
  17. When the child is ill with fever or diarrhoea continue to feed him as before, but you may have to prepare the food more appetisingly. You may have to force him a little. He will get better quicker if he eats plenty of cereal, pulses, green vegetables, etc.
  18. Encourage the child to play with simple household articles and things he can gather in the neighbourhood.
  19. Children cared for in this way are likely to be alert and curious and grow well.
  20. Children cared for in this way are likely to survive much better than those who are not. You may not want so many children, family planning can show you how to achieve this.

### **3.2.3 Environmental Health Programmes**

The environment should be comfortable, clean and safe.

The water, milk and food supply must be free of harmful toxins or infectious agents. Disease-carrying insects must be excluded. Accident hazards need to be removed or controlled in accordance with the ability of infant and child, in order to prevent the much too frequent tragedy of accidental death or permanent disability.

### **Direct Outputs of Environmental Health Programmes**

Programme 1	Direct Outputs 2	Intermediate effect or Impacts 3	Ultimate effect of Benefits 4
Water Supply	Safe water provided to households in adequate amounts and used efficiently.	Reduced disease from water borne pathogens; support to hygiene, and economic activity.	Longer Survival
Water Pollution Control	Reduced contamination of (used water returned to) water courses, seas, soil and food.	Improved water resources for human use; reduced damage to marine life; improved aesthetics.	Less disability, suffering, impairment and pain
Solid Waste Management	Wastes confined removed and disposed of (treated, recycled)	Improved water resources for human use; reduced damage to marine life; improved aesthetics.	Less disability suffering, impairment and pain.

(Contd.)

1	2	3	4
Air Pollution Control	Reduced introduction of toxic, irritant and nuisance elements into ambient air.	Reduced death disease and discomfort, reduced economic losses, improved aesthetics.	More efficient personal and social performance
Occupational Health	Released physical/chemical hazards in work environment, through primary and secondary disease precaution services.	Reduced illness, trauma and poisoning, safer work environment, improved working conditions and productivity.	Improved quality of life.
Food Sanitation	Food safeguarded against contamination in production, processing, delivery preparation and consumption.	Reduced disease and death from pathogens and toxins in food, enlarged markets, improved aesthetics.	Socio-economic development

**Source :** J.C. Mehta, *Habitat*, 1977.

### 3.2.4 Child Survival

Growth monitoring charts, packets of oral rehydration salts and vaccines, are low-cost life-saving growth-protecting technologies which can enable parents to protect their children against the worst effects of poverty. Similarly, a matrix of up-to-date and down to earth information about pregnancy, breastfeeding, weaning, feeding during and immediately after illness, child spacing, and how to make and use home-made oral rehydration solutions, could also empower parents to protect the lives and the health of their children.

But how can these technologies and this information be put at the disposal of slum dwellers? Significant improvement in the health of the poor world's children will depend on how well that question can be answered.

### 3.2.5 UNICEF Focus

Everyday 40,000 children die from infection and malnutrition, a preventable tragedy that should shame the human race.

"The most shameful fact on earth is every week over a quarter million children are being killed by malnutrition," the UNICEF Executive Director, Mr. James P. Grant, told a news conference, "This is our planet's silent emergency but it, doesn't make the headlines. Our message is : what can be done must be done."

A report said 14 million children die every year from avoidable illnesses. It further said, "The death of an estimated five million children every year from six preventable childhood diseases is an appalling indictment of the way we run our world and an immense challenge to our conscience and abilities."

UNICEF officials, who have made global immunization a goal by the early 1990s, say almost a quarter of all infant deaths in the developing world occur in India.

The 110-page UNICEF report (1987) said, "It is UNICEF's belief that significant inroads can be made against this silent emergency within the next decade—leading to child death rates in the early 1990s which will be only half those of the early 1980s." It said that because of economic recession, 1986 was the seventh consecutive year of negative or negligible income growth in the Third World, and children were the main losers.

A supplementary report would show that malnutrition, low birth-weight and child deaths were increasing among the poor, UNICEF said.

### 3.3 The Old

It is considered that old age is such an incurable disease that its final treatment can be done only once and that is on lit pyre. Rightly so 'you do not heal old age, you protect it, you promote it, you extend it'. While in India only 3.2% of the total

population are above 70 years of age, in U.K. the corresponding figure is 12 %. But in India the feelings and appearance of being old comes sooner. Some people become grandfather and grandmother at 40 and pronounce themselves old. Many others bend their back under the burden of poverty, wants, diseases and deprivations. A few others are buried under the mentality of old age at a comparatively younger age. In slums not many live long enough, so as to be really called old, hence the health and welfare measures required for the old are called upon less often. However, in the slums, those who are not so old, also require the same attention as the old. In fact the condition of these young-olds is worse than the old of developed areas, because of the evils of poverty, starvation, dehydration, loneliness, neglect, abandonment and ill health. An old-sick person is doomed completely, when poor. The health measures required for the old in the slums include at least two square meals, reduction of mental and physical agony, clothes to cover the bare skin, old age homes, some measures for entertainment, prevention of accidents, adequate medical attention and medicines. Could the old be made useful to themselves or the society?

Common problems in the old age are : (a) cataract and glaucoma leading to blindness, (b) deafness, (c) arthritis, (d) failing sense organs, (e) failing memory, (f) cancer (g) accidents, (h) asthma, (i) constipation/diarrhoea, (j) diabetes, (k) urinary infections, (l) inability and depression (m) hypertension and heart diseases, etc.

### **3.4 Unbridled Reproduction**

The hazards and risks to the health and life of mother and child, resulting from unbridled reproduction have been well recognised *i.e.*, low birth weight babies, severe anaemia, abortion, bleeding during pregnancy or delivery, high death rate of new born or mother or both, specially for a multipara. This important health area is the most neglected aspect in the slums and other low socio-economic areas. The unregulated multiplication is not inspired by the urge of procreation alone, it is due to apathy, ignorance, callousness, idleness, illiteracy, poverty

and environmental stress. The slum population has generally nothing else to do—except celebrating a new birth and mourning a death—almost a full time business for them. It is fairly common scene to have child birth for the daughter/daughter-in-law and mother/mother-in-law concomitantly. Similarly, one hears about a new arrival in the family one day and death of child or mother or both on the next day, as if different scenes are being enacted on a stage. In this process, health is the biggest casualty. With continued poor health, the overall welfare and well-being of the family and the community is affected. Where to begin ?

The aim should be to identify target couples 'in need of family planning services (and not only those who demand it) and to provide the services at the door steps of every household. Some degree of persuasion/pestering/coercion may be required, on the merit of each case (and not to complete the target only). The introduction of new intrauterine contraceptive, safer pregnancy termination, female sterilization under leproscopy, long acting progestrone injections can contribute a great deal in controlling unbridled births and deaths in the slum areas.

While reaching for small family norm, it would be necessary to assure and demonstrate on a long term basis that, it will result in healthier babies and mothers and they will survive for their normal span of life. This will entail better ante-natal care and continued follow up of the child and mother, after delivery. Besides providing services and nutrition and immunization, it will require health education and health consciousness. They will be more receptive, if the economic aspect of health protection is impressed upon—Better health means more money. A worker with a poor health or frequent ailments is not expected to earn adequately, when competition for employment is high even among the healthy persons. Similarly in a poverty-stricken family, if wife is occupied with pregnancies, births and deaths and husband in looking after her, what will happen to economy?

### 3.5 CBD

One new approach towards 'health for all' now being

emphasized is community-based distribution (CBD) and services. In CBD programmes, lay workers from the community provide important services and supplies. They involve village leaders, women's clubs, traditional midwives, or local retailers. Local workers distribute condoms, oral contraceptives, and sometimes other items, either free of charge or for a small fee, sometimes on a household-to-household basis.

In addition to family planning, other services are: oral rehydration therapy for diarrhoea (ORT), malaria treatment, intestinal parasite treatment, nutrition education and supplements, and immunization.

### *3.5.1 Oral Rehydration Therapy (ORT)*

ORT is used to treat dehydration due to diarrhoea. Diarrhoea is extremely common among children under age five and a major cause of death by causing dehydration. Although ORT does not prevent or cure diarrhoea, it is effective and safe in treating dehydration, if it is prepared and administered properly. Technically, ORT is simple. The oral rehydration solution can be mixed from pre-packaged ingredients and water or even made with household sugar, salt and water. Programmatically, however, ORT is demanding. Because too dilute a solution may be relatively ineffective and too strong a solution can be dangerous. CBD workers and village women need careful and repeated demonstrations and training. Moreover, mothers should be taught to continue breast-feeding and to give other liquids and food during diarrhoea. Teaching the mixing and use of ORT requires skills. Therefore, close supervision of CBD workers is necessary. Despite these demands, ORT is a valuable CBD measure with the potential for saving many lives.

### *3.5.2 Treatment of Malaria*

Malaria is endemic in many developing countries and may kill at least one million people annually. Community workers can use chloroquine and possibly other drugs to treat malaria. Single doses of these drugs lower fever, eliminate symptoms, and can cure the most dangerous type of the disease. Thus malaria treatment can have

an important health impact. In areas where chloroquine is effective, treatment of acute cases of malaria is relatively simple, safe, and inexpensive. Because treatment produces immediate results, community interest is likely to be high. Preventive doses for all children and pregnant women be even simpler than treatment.

### *3.5.3 Intestinal Parasite Treatment*

In slum areas almost everyone is infested with intestinal helminths, or worms. Drugs to combat these parasites are relatively inexpensive, quick-acting, and easy to administer to a whole slum colony.

### *3.5.4 Nutrition Measures*

CBD programmes have sought to deal with two nutritional problems—(a) insufficient protein and calories, and (b) specific vitamin and mineral deficiencies. Diet supplements of protein and calories have been used extensively, but the results are difficult to measure. Food supplements do not always reach the target groups, specially the women and children who need them most. In addition, protein-calorie supplements are expensive and raise logistical problems. Some programmes weigh infants regularly to alert families to infant nutritional needs. This form of nutrition education may be useful, if the families can be provided enough food to give more to a poorly nourished child.

Although insufficient food is by far the greatest problem, devoted workers can deal more effectively with deficiencies of specific vitamins and minerals. The workers can distribute vitamin A capsules to children every four to six months to prevent eye problems. Iron and folate supplements should be taken every day. It may be more feasible, for the workers to distribute these supplements to pregnant women. In areas of iodine deficiency, the workers can cooperate with mobile injection teams or distribute oral doses of iodine to prevent goiter and cretinism. The CBD workers can involve voluntary agencies also, who otherwise willing to spend, do not know how and where?

### *3.5.5 Immunization*

Immunization against diseases such as diphtheria, whooping cough, tetanus, measles, and polio has a substantial impact on health, but immunization programmes are too complex for lay workers. The determined workers can play an important supporting role in immunization programmes. They can encourage women to have their children vaccinated and to be vaccinated themselves. They can arrange, coordinate and publicize the visits of the immunization teams.

### *3.5.6 Problems of Implementation*

The most difficult tasks in such programmes are likely to be recruiting and training devoted workers, providing continued supervision, coordinating backup with the existing medical system, keeping supplies flowing, and evaluating the programme and revising it as needed. If self seekers get access to this programme, we come back to the square one.

- (a) Such projects should avoid a service overload, in which workers with limited training are expected to do more than they can.
- (b) New activities should be phased in on a step-by-step basis.
- (c) Training and supervision must be a continuing part of any programme.
- (d) Community participation is desirable—through village leaders, women's groups, or other organizations.
- (e) Combining family planning with other health services is not necessary to make family planning acceptable.
- (f) Operations research is needed to discover how best to design and implement an integrated programme.

### *3.5.7 Primary Health Care and Other Health Measures*

A number of other health measures have been tried or suggested for CBD workers :

- (a) Oral or topical antibiotics, especially to treat respiratory tract infections and trachoma;
- (b) Pain-killers such as aspirin; and
- (c) first-aid.

Of these, only antibiotics would treat important causes of mortality or serious morbidity. Severe respiratory tract infections such as bronchitis and pneumonia are a major cause of infant and child deaths in developing countries. But because of several potential problems, CBD workers should not be allowed to distribute (without supervision) antibiotics for treatment of respiratory infections.

Trachoma, a major cause of blindness, is often treated with tetracycline eye ointment. Treatment is prolonged—at least six to eight weeks of daily application for individual acute cases, and commonly, two applications daily for five days each month for six months, repeated each year, in curative or prophylactic mass campaigns. Use of oral antibiotics in addition can be more promising for CBD, under expert supervision.

Aspirin may be much in demand in many communities, to relieve pain, to lower fever, and to reduce inflammation. The ability of aspirin to lower fever makes it a useful adjunct in the treatment of malaria, respiratory infections, and other illnesses. Distributing aspirin as a pain-killer does not meet a major public health need but does respond to very common complaints and so it is popular.

Minor cuts, sprains and mild burns are, of course, quite frequent, and simple first-aid measures have been included in many CBD programmes. CBD workers often may be the only personnel with medical training available in an emergency, and so they will be called on. As with other measures, however, first-aid requires special training. Workers must not go beyond emergency care and attempt tasks for which they are not qualified, such as setting broken bones. These should be handled by the backup medical system. The list of primary health care services that CBD might try can be long.

### **3.6 Immunization**

Nearly 30 per cent of child deaths are due to six common

communicable childhood diseases. In India five million children die each year. As noted earlier, tetanus is a leading killer of newborn babies. On an average, measles kill two out of every 100 children it strikes in India; the proportion is as high as 10 in 100 in malnourished groups. Hundreds of thousands of Indian children are afflicted by tuberculosis and those who escape death are prone to suffer permanent brain damage or bone deformity. Whooping cough ravages the respiratory systems of similar numbers. Diphtheria kills a large number of children and leaves many more permanently affected with damage to heart and brain. Few die of poliomyelitis but the lives of tens of thousands are shattered for want of an inexpensive vaccine.

Of all health services, immunization is the most simple and cost-effective. The expanded programme on immunization (EPI) was launched in 1978 in India. There are more than 20 million eligible children for immunization each year. In 1982-83 the actual coverage was 38.2 per cent for DPT, 17.7 per cent for polio, 8.8 per cent for BCG and hardly any for measles. The measles vaccine is not made in India while the others are, though not to the required quantity.

The national aim to achieve 85 to 100 per cent coverage in all the six diseases by 1990 will be possible only if the programme rapidly accelerates.

This is the single most important and achievable step to bring down death and diseases among children and mothers of slums. In each city, if a task force is created, with the participants of slum dwellers, to give adequate protection to their children it will help a great deal. It will be necessary to have proper follow up and maintenance of record for each slum child. The half-hearted measures taken occasionally and on *ad hoc* basis often to get cheap publicity by the government and voluntary agencies has made mockery of this programme of paramount importance. Only concerted efforts with regular and proper follow up can stem the tide of dreadful communicable diseases in the slum areas.

If the breeding could be curbed and both the husband and wife could go to work, things could look up for the better in the areas of economy, health and welfare.

#### 4. FOOD AND MALNUTRITION

Food as a means of health is linked to many factors like: distribution of income, "entitlement" to food, production and commercial distribution of food, family knowledge and behaviour about the use of food, epidemic and environmental diseases affecting bodily needs, and government and community policies and services such as food subsidy to lower income groups. Expectant and lactating mothers, the children and the old are particularly vulnerable to malnutrition. According to an estimate, out of more than 270 million children of India, the number who have access to essential nutrition and adequate food is less than half. The condition of mothers and the old is even worse.

##### 4.1 Surveys and Indexes

In urban slums the situation is worse with 25 per cent of households meeting neither calorie nor protein requirements, another 29 per cent meeting protein requirements but not calories resulting in over 54 per cent of households being inadequate in calorie consumption.

Surveys by the National Institute of Nutrition in the past two decades indicate that about 85 per cent children suffer from varying degrees of malnutrition.

*India Population Project* in a survey, among pre-school children noted that about 60 per cent of them were suffering from either moderate or severe degree of malnutrition. About 1.4 per cent of pre-school children had severe forms of protein-energy malnutrition (PEM). The diets were deficient in most nutrients, particularly in respect of calories, protein and vitamin A.

Measures to improve the nutritional status can be broadly divided into two: (a) Direct interventions cover a wide range of activities, viz., supplementary feeding programmes, distribution of iron and folic acid tablets, fortification and enrichment of foods, nutrition, education, etc. Indirect nutrition interventions have still wider ramifications. These include measures such as control of communicable diseases through immunization, improvement of environmental sanitation, provision of clean

drinking water, family planning, food hygiene, education and primary health care (Park and Park, 1985).

#### **4.2 Micro-nutrient deficiencies**

The deficiencies of micro-nutrients like vitamin A, iron, B group of vitamins and iodine are micro-nutrient deficiencies. These manifest slowly but have severe, handicapping consequences for the growing children. There is an overlap between calorie deficiency and other nutrient deficiencies because these deficiencies are attributes of poverty.

##### **4.2.1 Iron**

Studies have shown that 63 per cent of India's children below three years and 45 per cent between three to five years suffer from iron-deficiency anaemia. A rural study estimated that more than 90 per cent of pre-school children suffered from anaemia (haemoglobin less than 11 gm%).

In a study at Baroda in slum settings, it was found that 60 to 94 per cent had nutritional anaemia and 35 to 58 per cent had parasitic infestation. Worm infested slum children had significantly lower haemoglobin values than the uninfested. At a cost of Rs. 13.40 per child per year the combined administration of vitamin A, iron-folic acid and anti-helminthics helped reduce both anaemia and vitamin A deficiency.

This indicator is of great significance to save the health and life of children and mothers in slums. The society, either through voluntary effort or the government agencies have to earmark and honestly spend at least a sum of Rs. 13.40 per child (also per mother) per year. This is practical, advisable and within our means. A great beginning can be made by inflicting this welfare programme.

The major cause of iron deficiency anaemia is inadequate intake or poor absorption of iron from predominantly cereal-based diets. The estimated intake of dietary iron by different groups is far below the recommended allowance. Of this already inadequate intake, nearly 25 per cent is not absorbed. Frequent episodes of infection and hookworm infestation

further aggravate iron deficiency, especially in pre-school children of slums and rural populations.

One approach to control the problem of iron deficiency is to fortify a suitable food item with iron. Salt has been suggested as an ideal vehicle for iron fortification. Second approach is to distribute iron tablets alongwith other nutrients among the community members who need it most.

#### 4.2.2 Vitamin A

According to government estimates atleast 30,000 children are becoming blind each year due to vitamin A deficiency. Another estimate states that xerophthalmia damages the sight of 40,000 Indian children under five every year. A 1978 report (Shah) estimated that of the 92 million Indian children below 6 years, 7.4 million have symptoms of vitamin A deficiency. Amongst those whose malnutrition worsens to the point of severe corneal involvement he estimated that 60 per cent die and of those who survive, each year, 42,000 become totally blind and another 78,000 are partially stricken.

A community-based strategy would be to ensure that the hepatic stores of vitamin A be built up periodically (since the liver can store large quantities of vitamin A and release them periodically) through an oral administration of 200000 IU of vitamin A dissolved in oil to children aged one to five years, once in six months.

The long-term measure consists of a combination of nutritional rehabilitation (use of green leafy vegetables, brown vegetables and yellow fruits rich in vitamin A), education of mothers who will work closely with the *balsevika* to monitor the therapy on the child and a consequent change in food habits of the family.

#### 4.2.3 Iodine

Some 40 million people in India (especially in the sub-Himalayan belt) have been seriously affected by iodine deficiency, despite the National Goitre Control Programme started 20 years ago. Earlier estimates indicated that 120 million (over a fifth of the population) were exposed to endemic goitre.

However, a revised estimate is 170 million, following the identification of new endemic areas. This figure is expected to go up to 200 million by A.D. 2000.

Among the recommended measures are : (a) intensive education programmes beamed on the public of the endemic States; (b) focus on iodine deficiency disorders in the training of auxiliary health personnel, and the *anganwadi* workers in ICDS programmes; (c) ensuring the use of iodinated salt by the people and also in the feeding of children and mothers attending *anganwadis* in the ICDS programme; (d) education of families in the use of iodinated salt; and (e) helping health agencies in monitoring the use of ioninated salt.

#### **4.2.4 Infant Feeding Practices**

*Breast Feeding* : In rural societies the healthy practice of breast-feeding of babies is continued as long as the mother's milk is not exhausted either in the natural biological course or consequent on another pregnancy in contrast to urban areas, where the practice is on the decline. But in the slums, breast feeding is stopped early and introduction of weaning foods at the appropriate time is missing due to ignorance and poverty.

There is a broad tradition in India of prelacteal feeds with honey or some form of sucrose. This also reveals the harmful practice of discarding colostrum which is invaluable in building immunity in the newborn. The contrary belief that colostrum is harmful to the infant seems to be held both by mothers as well as among the traditional birth attendants. Newborn diarrhoea is essentially a 'colostrum deficiency' syndrome, while infantile diarrhoea (especially in 6 to 9 month old babies) is more common in bottle-fed babies. It is, therefore, important for the health, development and survival of infants that breast-feeding be protected and encouraged and weaning foods introduced at the appropriate age. The child moves through a critical passage of survival threat from malnutrition from 6 months to 18 months when weaning has begun but the supplementation remains inadequate. Deaths during the period of weaning in developing countries, specially the slums and rural areas are 15 times higher than in developed countries.

Breast-feeding has several advantages—it builds immune

bodies in the child offering protection against infection, it is economical, it helps prevent the possible contamination in bottle feeding, it helps to protect (if the child sucks with the necessary frequency, intensity and duration) the women from an unwanted pregnancy, it helps the contraction of the womb after delivery, it promotes a vital psychological bonding between the mother and the baby, and, of course, there is no known better food for the infant than the mother's milk.

Two studies in slums, reported that in 75 to 80 per cent cases breast-feeding started two to seven days after birth.

An analysis of several Indian studies on breast-feeding practices suggests the following:

- (a) Nearly 90 per cent of the population covered by the surveys started breast-feeding later than necessary on the second or third day after birth.
- (b) While educated mothers were more aware of the needed frequency and duration of breast-feeding, illiterate mothers did not adhere to any specific time schedule for breastfeeding.
- (c) Colostrum was considered unnecessary or harmful even by health personnel.
- (d) Personal hygiene, like washing of nipples and use of clean garments, was seldom observed by mothers.
- (e) Weight gain was maximum for breast-fed infants upto six months, as compared with artificially fed infants.
- (f) The working status of urban mothers in the higher economic strata adversely affected breast-feeding. In comparison poor urban working women breast-fed their babies longer.
- (g) Age and educational level of mothers was inversely related to breast-feeding.
- (h) Feeding bottles were inadequately cleaned. In one survey 50 per cent of the mothers were seen to clean bottles only once a day.

These studies have also shown that artificially fed infants were three times more susceptible to diarrhoeal infections, and two times more likely to contract respiratory infections, than infants who are breast-fed.

#### **4.2.5 Weaning**

Too early an introduction of weaning foods involves the risk of infection and adverse effect on lactation. Too late an introduction would be harmful to the infant's growth and development arising from insufficient quantity of breast milk.

A WHO study of weaning practices by rural mothers in India showed that by 6-7 months only 12 per cent of the mothers gave complementary feeds. Many of them started weaning foods at one year or later, resulting in protein energy malnutrition of the child.

While exclusive breast-feeding in the first six months may be appropriate in the case of well-nourished mothers, it may be necessary to start the baby on weaning foods after four months in cases where breastmilk is less than the baby's requirement.

### **4.3 Maternal Malnutrition**

Girls enter into marriage and motherhood from their pre-existing malnutrition and impair their health further. Cultural traditions of intra-family distribution of food, rooted in rural areas, compel women to eat last and often the least both in quantity and quality. While the low nutrient intake may help to maintain her own health and nutritional status, such as it may be, the demands on the body during pregnancy and lactation drastically deplete her already scarce reserves, leading to ill health.

The nutritional status during pregnancy and lactation seriously affects women of poor families. Anaemia is itself the most common manifestation. It is estimated to affect upto 50 per cent of Indian women from the lower socio-economic groups in the later part of pregnancy with haemoglobin levels below 11 gm. About 10 per cent of all maternal deaths in India are attributed to anaemia.

A study of poor women in India subsisting on a diet of less than 1800 kcal a day showed that nearly a third of the pregnancies were wasted in miscarriages and still-births. It is possible that the human being is able to function at different levels of nutritional intake. But this can be true only upto a point.

The total energy requirement to meet increased demands during pregnancy has been estimated at about 80,000 calories. This means an average increment of 285 calories per day over the 280 days; or, more specifically 150 calories a day in the first trimester and 350 calories during the second and third trimesters.

The total extra dietary energy required during lactation would be around 100000 kcal or about 550 kcal per day. For a very young mother, the nutritional demands of motherhood will be more. For, a young woman who is still maturing will require energy for her own growth as well.

The effect of poverty on maternal malnutrition is clear. A calorie deficiency of 540 kcal per day can depress by as much as half the normal weight gain of 12 kg during pregnancy. Inadequate weight gain results not only in low birth weight but also in low fat stores unequal to the energy demands of breast-feeding.

#### *4.3.1 Low Birth Weight*

The nutritional well-being of the pregnant woman is the most decisive factor in preventing low birth weight for the baby. The birth weight is the most decisive factor in the chances of infant survival. To provide adequate food to a pregnant woman is the most cost-effective single point at which to break the prevailing cycle of malnutrition, poverty and ill health in the slums.

Low birth weight babies (that is below 2.5 kg) are three times more likely to die in infancy than babies of normal weight at birth. In India each year 7-10 million children are born with low birth weight, that is, at least a third of all children born. The incidence of low birth weight babies is much higher in slums, as compared to average. Consequently the infant death rate is also higher.

#### **4.4 National Programmes**

These programmes may be classified as :

- (a) Programmes designed to improve the overall nutritional status—

- (i) Applied nutrition programme.
- (ii) Supplementary feeding programmes.
- (iii) Mid-day meal programme for school children.
  
- (b) Programmes aimed at overcoming specific deficiency diseases—
  
- (i) National goitre control programme.
- (ii) Vitamin A prophylaxis programme.
- (iii) The iron and folate distribution programme.
  
- (c) Others—
  
- (i) Integrated Child Development Scheme.
- (ii) India Population Project.

The Applied Nutrition Programme (ANP) jointly sponsored by the Government, UNICEF, WHO and FAO started in 1959 for children of pre-school age and pregnant and lactating women. The mid-day meal programme in school launched in 1962 was an effort to simultaneously increase school enrolment and improve child nutrition. Hardly 10 per cent of the target population has been covered by this programme. Resultant improvement in the nutritional status of beneficiaries has been minimal, due to reasons like the sharing of food, worm infestation, deprivation of home food to children and pilferage.

Programmes for distribution of fortified foods (*e.g.*, "Modern bread", Miltone and *Balahaar*) for vulnerable groups were initiated in 1968, with UNICEF assistance. The Special Nutrition Programme (SNP) launched in 1970-71 was meant to provide supplementary nutrition to millions of children below 6 years and expectant and nursing mothers living in urban slums tribal areas and backward rural areas. The SNP aimed at bridging the existing nutritional gap by providing 300 calories and 10-12 grams protein for children and 500 calories and 20-25 grams of protein for mothers for 300 days in a year. The Integrated Child Development Services (ICDS) were started in 1975-76.

By 1985 ICDS is supposed to have provided (a) immunization and health check-up to 10 million children, (b) supplementary nutrition to 6.1 million children and 1.1 million pregnant and lactating women, and (c) non-formal means of pre-school learning to three million children. This coverage is likely to treble during the Seventh Five-Year Plan (1985-1990).

### 5. CLOTHES AND SHOES

Clothes and shoes are essential for every human being, not only to get a feeling of well being, look elegant and dignified to cover the skin and to protect against the vagaries of weather, but also to prevent disease and injuries. In the slums, like food, clothes and shoes are also available sparingly. The clothes are scanty to cover only certain areas of the body. Whatever little are available are torn and dirty. The male folk have just a loin cloth or an underwear, occasionally with a *banyan*. The women cover their torso and lower part with a 2-3 metre rag, which may be called *sari*. The young children are either wholly or almost entirely naked. The condition of the old may be even worse than the rest. In the name of bedding, an old worn out *dari* or a sac is all, what is available. During winter, one rag with cotton, called *quilt* may be shared by a number of members. The shoes for the entire slum population is an unnecessary evil or big luxury, hence conspicuously absent. Discernible marks of multiple injuries and boils are seen on the feet and other parts of the body. The incidence of worm infection is very high, due to the bare foot habits. It would be desirable to provide at least a pair of shoes and two metres of coarse cloth to every slum child by the Welfare Department of Government of India/other Welfare Agencies.

### 6. HOUSE AND HOME

WHO defines a house as the residential environment—the physical structure that man uses for shelter and the environment surrounding it, including all necessary services, facilities, equipments and devices needed or desired for the physical and mental health and social well-being of a family. The concept of home,

extends beyond that of the physical structures and facilities i.e., it also means love, affection, harmony, comfort, development in the company of both parents and sibs. In a slum environment home is almost non-existent.

In the name of a home, just an apology viz., a *jhugi-jhompri* in a *katra*, lane, *chawl*, *bustee*, *ahatas* cheris or a colony—where there is no water supply and no provision for excreta or refuse disposal.

### **6.1 What is Healthful Housing?**

WHO recommended the following criteria :—

- (a) Healthful housing provides physical protection and shelter;
- (b) provides adequately for cooking, eating, washing and excretory functions;
- (c) is designed, constructed, maintained and used in a manner such as to prevent the spread of communicable diseases;
- (d) provides for protection from hazards of exposure to noise and pollution;
- (e) is free from unsafe physical arrangements due to construction or maintenance, and from toxic or harmful materials; and
- (f) encourages personal and community development, promotes social relationship, reflects a regard for ecological principles, and by these means promotes mental health.

### **6.2 National Housing Code in India**

The following standards are recommended :

- (a) *Site* : (i) The site should be elevated from its surroundings so that it is not subject to flooding during rains, (ii) the site should have an independent access to a street of adequate width, (iii) it should be away from the breeding places of mosquitoes and flies, (iv) it should be away from nuisances such as dust, smoke, smell, excessive noise and traffic, (v) it should be in pleasing surroundings, and (vi) the soil should be dry and safe

for founding the structure and should be well drained. The sub-soil water should be below 10 feet.

(b) *Set back* : For proper lighting and ventilation, there should be an open space all round the house—this is called “set back”.

(c) *Floor* : The floor should be *pucca* and satisfy the following criteria : (i) it should be impermeable so that it can be easily washed and kept clean and dry, (ii) the floor must be smooth and free from cracks and crevices, (iii) the floor should be damp-proof, and (iv) the height of the plinth should be 2 to 3 feet.

(d) *Walls* : The walls should be (i) reasonably strong, (ii) should have a low heat capacity *i.e.*, should not absorb heat and conduct the same, (iii) weather resistant, (iv) unsuitable for harbourage of rates and vermin, (v) not easily damaged and (vi) smooth. These standards can be attained by 9-inch brick-wall plastered smooth and coloured cream or white.

(e) *Roof* : The height of the roof should not be less than 10 feet.

(f) *Rooms* : The number of living rooms should not be less than two. The number and area of rooms should be increased according to size of family.

(g) *Floor area* : The floor area of a living room should be at least 120 sq. ft. for occupancy by more than one person and at least 100 sq. ft. for occupancy by a single person.

(h) *Cubic space* : The height of rooms should be such as to give an air space of at least 500 c.ft. per capita, preferably 1,000 c.ft.

(i) *Windows* : (i) Unless mechanical ventilation and artificial lighting are provided, every living room should be provided with at least 2 windows, and at least one of them should open directly on to an open space, (ii) the windows should be placed at a height of not more than 3 feet above the ground in living rooms, and (iii) windows area should be 1/5th of the floor area. Doors and windows combined should have 2/5th the floor area.

(j) *Lighting* : The daylight factor should exceed 1 per cent over half the floor area.

(k) *Kitchen* : Every dwelling house must have a separate kitchen. The kitchen must be protected against dust and smoke;

adequately lighted; provided with arrangements for storing food, fuel and provisions; provided with water supply; provided with sink for washing utensils and fitted with arrangements for proper drainage.

(l) *Privy* : A sanitary privy is a must in every house, belonging exclusively to it and readily accessible. In the developed areas, the majority of dwelling units are equipped with water carriage systems.

(m) *Garbage and refuse* : These should be removed from the dwelling at least daily and disposed of in a sanitary manner.

(n) *Bathing and washing* : The house should have facilities for bathing and washing belonging exclusively to it and providing proper privacy.

(o) *Water supply* : The house should have a safe and adequate water supply available at all times.

### **6.3 Health and Home**

Home is to some extent responsible for the status of man's health and well-being. It is difficult, however, to demonstrate the specific cause-and-effect relationship because housing embraces so many facets of environment. By deductive reasoning, a strong relationship can be established between poor housing and the following conditions :

(a) *Respiratory infection* : Common cold, tuberculosis, influenza, diphtheria, bronchitis, measles, whooping cough, etc.

(b) *Skin infection* : Scabies, ringworm, impetigo, leprosy.

(c) *Rat infestation* : Plague.

(d) *Arthropods* : Houseflies, mosquitoes, fleas and bugs.

(e) *Accidents* : A substantial proportion of house accidents are caused by some defect in the home and its environment.

(f) *Morbidity and mortality* : High morbidity and mortality rates are observed where housing conditions are sub-standard.

(g) *Psychosocial effects* : These effects must not be overlooked. The sense of isolation felt by persons living in the upper floors of high buildings is now well known to have harmful effects.

#### 6.4 IYSH

The year 1987 is being celebrated as the International Year of Shelter for the Homeless (IYSH). In India the shortage of housing in 1985 was estimated to be 24.7 million houses (18.8 in rural area and 5.9 in urban area). Also the revised 20-point programme of the Government of India has emphasised on providing houses to the slum dwellers (Point 10) and rural homeless (Point 9). Improving the human settlements is bound to improve the process of economic development of adequate these unfortunate beings. In spite of the fact that housing to the urban poor will require enormous amounts of budgetary outlays, this input will usher in a welfare State, where one-third of our urban population, condemned to death and decay, will have a feeling of well-being. Let this year bring new hopes to the homeless and fulfilling their aspirations to own a shelter.

### 7. WATER AND SANITATION

Water and sanitation are fundamental to healthy life. If we broadly look at the slums, these two vital components of health and welfare are missing and that is precisely the reason of the slums to be dirty and stinting. Lack of protected water for drinking and bathing, etc. results in several ailments. It has been estimated that 73 million man days are lost in India every year due to the water-borne diseases alone. Coupled with this loss is the colossal amounts required to treat these patients, who suffer from waterborn diseases.

In a typical slum study (Singh and Pothen, 1982) at Indore, the researchers noted that the slum was situated between two dirty *nallahs*, which carry the sewage from one part of the city to the other. The municipal corporation had provided just one tap for the whole area, inhabiting 1,229 people. Children, pigs and other animals used the *nallah's* water for bathing and playing. The adults would dig a small ditch near the flowing *nallah*, and that water was used for cleaning utensils, garments etc. The whole place stinked badly. The area had open drainage system and the inhabitants defected in the open. This shows

that primarily the problems were related to non-availability of water and the second was lack of sanitary habits.

India's commitment to the decade is definite. The goal is to provide water for all by the year 1990. The sixth plan's budget for water and sanitation has arisen to Rs. 4,177.51 crores as compared to a paltry Rs. 49 crores in 1951-56.

At the beginning of decade (1981) 77.7% of cities and towns and 31.1 of villages had supply of protected drinking water. Only 0.5% of rural people had some sanitary facility for disposal of human excreta. Almost the entire population of villages: 52 crores of them, defected in the open. Thirty-three per cent of urban households had no latrines. Now the target is to cover 80% of urban areas and 28% of rural areas for excreta disposal. The estimated expenditure on this account is Rs. 14,700 crores.

In the slum areas if piped water supply and flush latrines are still a dream to come true one day, it would be desirable to provide adequate number of hand pumps, community latrines and covered drainage of waste water. With this infrastructure, it would be possible to think of personal hygiene.

### **7.1 Personal Hygiene**

This term includes bathing and washing, care of clothing, care of teeth, care of hair, care of feet and nails, care of posture, cultivating good habits regarding eating, diet, exercise, sleep, smoking, drinking and attitudes towards life. Any disruption of these activities may impair health. For example, neglect of oral hygiene may predispose to tooth and gum ailments; neglect of personal cleanliness may predispose to scabies, eczema and fungal infection; excessive smoking may lead to chronic bronchitis and lung cancer; and over-eating to obesity. The practice of personal hygiene is largely a matter of individual responsibility. Since the foundations of personal hygiene are laid in early childhood, the goal in community health should be to provide a broad range of relevant information about health, illness and disability, and ways in which individuals can protect themselves and improve their own health, to the slum children.

## 7.2 Excreta Disposal and Disease

Human excreta is an important cause of pollution and every society has a responsibility for its safe removal. The problems of improper excreta disposal can be (a) soil pollution, (b) water pollution, (c) contamination of foods, and (d) propagation of flies. The diseases which can occur due to the pollution are typhoid and paratyphoid fever, dysenteries, diarrhoeas, cholera, hookworm disease, ascariasis, viral hepatitis and a host of other intestinal infections and parasitic infestations.

Statistics indicate that water and food borne diseases claim about 5 million lives every year, while another 50 million people suffer from these infections. The enteric group of fevers is very common in rural areas and urban slums, the annual incidence varying from 102 to 2,119 per 100,000 of population. Hookworm disease is also known to be very common. The solution to the problem is only thorough, hygienic disposal of human waste.

### 7.2.1 How Disease spreads?

The human excreta of a sick person or a carrier of disease is a source of infection. The disease is transmitted to a new host through various channels : (a) water, (b) fingers, (c) flies, (d) soil and (e) food.

### 7.2.2 Disease Cycle

The disease cycle may be broken by placing a sanitation barrier between the faeces and the human host, by segregation of faeces, protection of water supplies, protection of foods, personal hygiene and control of flies. Of these, the most effective step would be proper disposal of excreta, by a 'sanitary latrine' and a disposal pit, or installation of a sewerage system and sewage treatment.

### 7.2.3 Excreta Disposal, How?

There are a number of methods of excreta disposal. The

mode of disposal would be through one or more type of latrines.

(a) *Conservancy System* : Nights-oil is collected from pail or bucket type of latrines by human agency, and later disposed of by burying or composting.

(b) *Sanitary Latrines* : like bore hole latrine, dug well or pit latrine, water-seal type of latrines, septic tank, Aqua privy, or chemical closet.

(c) *Camp Latrines* : such as shallow trench latrine, deep trench latrine, pit latrin, or bore hole latrine.

(d) *Flush Latrines* : This is the ideal system.

In several other studies, like Pahawa (1969), at Indore, Shah (1968) at Palghat Taluka, Rathor. *et al.* (1975) at Jaipur, the researchers found that malnutrition due to paucity of food and water was widely rampant.

## **8. COMMON HEALTH PROBLEMS IN SLUMS**

Slums have several physical and behavioural health problems :

### **8.1 Physical Health Problems**

Physical health problems in various vulnerable groups, which are associated with poverty, low socio-economic status and illiteracy have been mentioned in the foregoing sections. Morbidity pattern in a study in children (Singh and Pothen, 1982) at Indore is reproduced in Tables 1 and 2.

### **8.2 Behaviour Problems**

Poverty coupled with disturbed child-parent relationship results in emotional problems among the inhabitants of slums, specially the children. Common problem in a high percentage of these children are bed-wetting, stammering, thumb-sucking and nail-biting, stealing, destructiveness and cruelty, or timidity, masturbation, sexual deviation, neurotic traits, shy and withdrawn, day-dreaming, hysteria, tremors, headaches, phobias and fears, school failures and delinquency.

**Table 1 : Morbidity Pattern upto 2 Years of Age**

Morbid conditions	Percentage of children
Marasmus	46
Cervical adenopathy	41
Hepatomegaly	35
Rickets	23
Vitamin A deficiency	20.6
Worm infections	11.5
Skin diseases	11.5
Splenomegaly	0.6

**Table 2 : Morbidity Pattern in Children from 2-12 of Age Group**

Morbid conditions	Percentage of children
Worm infections	24.2
Cervical adenopathy	5.9
Dental caries	4.2
Scabies	3.9
Vit. A deficiency	3.5
Chronic suppurative otitis media	3
T.B.	1
Encephalitis	0.9
Infective hepatitis	0.5

### 8.2.1 What is Delinquency?

The Children Act (1960) in India defines delinquent "as a child who has committed an offence", e.g., theft, sexual assault, murder, burglary, inflicting injury on others, etc. But it embraces all deviations from normal behaviour of children, youth and others e.g., incorrigible, ungovernable, disobedient, those

who desert their homes, mix with immoral people, with behaviour problems, indulging in anti-social practices, etc. (Park and Park 1985).

### 8.2.2 *Causes*

Some of the causes may be death of parents, separation, step mothers, disturbed home or broken home, poverty, alcoholism, parental neglect, severe punishment, lack of discipline, lack of moral teaching, ignorance about child care, too many children, absence of recreation facilities, cheap recreation, sex-thrillers, urbanisation, cinemas and television, etc.

### 8.2.3 *How to Prevent?*

A well adjusted family and school life can stem the tide of delinquency. The needs of children should be appreciated and met wherever possible. The school teacher can play an important part by detecting early signs of maladjustment. Within the means, the family and society has to give due attention and protection to the children.

## 9. WHAT CAN WE DO

To improve the health and welfare of the unfortunate slum dwellers, tangible and honest steps (extending beyond publicity) are required by the State and voluntary agencies like Rotary Clubs/Loin Clubs/Mohalla associations and the community workers from the slums. There has to be a integrated minimum needs programme, to ensure at least two square meals, a coarse cloth to cover the body decently, sanitary houses, where at least protected water and disposal of excreta facilities are available; free facilities of vaccination and medical treatment at the door steps, compulsory limited families, iron and vitamin tablets for the specially vulnerable and health education. This will go a long way to bring a sense of dignity, hope and usefulness for the citizens, who are a neglected lot due to circumstances. One who obstructs the percolation of these welfare steps to the target groups or tries to usurp the food and other materials meant

for this segment, required to be jailed. Let this be understood that slum dwellers can become a resource, rather than a nuisance or an encroachment on the beautiful cities. However, further growth of slums should be curtailed firmly.

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## CHAPTER 5

# *Environment and the Lungs*

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The respiratory system consists of a conduction zone and a gas exchanging zone. The conduction zone can be divided into upper airways (nose and mouth, pharynx and larynx) and lower airways (trachea and bronchi). It is a kind of branching-tube system with the trachea dividing into the main bronchi and it goes on dividing into sub-divisions forming a large bronchial tree. Each terminal bronchial division ends up in a bunch of polyhedral structures called alveoli which form the gas exchanging zone. The alveoli are thin walled structures surrounded on all sides by blood capillaries. It is here where the gaseous exchange (normally oxygen and CO<sub>2</sub>) between the air in the alveoli and blood in the capillaries take place. The gas exchanging layer is called the alveolar capillary membrane and it forms a barrier to many inhaled constituents to enter the blood. There are some 300 million alveoli in the lung, with a surface area almost as large as a tennis court. These are in direct contact with the atmosphere and are, therefore, constantly exposed to the ravages of the environmental pollution. The larger sized particulate matter present in the inhaled air is trapped in the nasal hair and upper respiratory passages. The other pollutants reach

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the terminal gas exchanging alveoli of the lung. While the small sized particles get deposited in the alveoli and may cause injury, the gaseous and soluble pollutants cross the barrier of alveolar capillary membrane and enter the blood, thereby circulated to the whole body tissues.

### **Defences of the Respiratory System**

There is a fairly efficient protective mechanism for the defence of the respiratory gas exchange membrane. The non-specific protective mechanisms are aerodynamic filtration, movement of the respiratory tract fluids propelled by ciliary action, detoxification and packaging of inhaled particulates by the phagocytic cells—the alveolar macrophages. The specific defence mechanisms involve the immunologic response to inhaled organic material.

### **Defences I : Deposition and Clearance Mechanisms<sup>1,2</sup>**

Generally, upto a kilogram of dust may enter the respiratory tract in a working life of 30 years. It is likely to be much more in a dusty and smoky environment. But at post-mortem, not more than a few grams of dust are found in the lungs. Most of the dust particulate matter also filtered in the upper airways. Particles smaller than 1  $\mu\text{m}$  reach the lower airways and get deposited. The removal mechanisms include cough (a very rapid clearing process) and mucociliary system.<sup>3</sup> The clearing rate varies from  $30 \pm 10$  min from large bronchi,  $2.5+0.5$  hr from most of the bronchial tree to 5-6 hours from peripheral airways. The uncleared particles are removed by phagocytic cells resident in the alveoli—the alveolar macrophages and by lymphatics present in the lung interstitium. The lymphatic clearance occurs over a period of months to years.

The upper airways also absorb gaseous pollutants like sulphur dioxide ( $\text{SO}_2$ ) and to a lesser extent, ozone.<sup>4,5</sup> The gas absorption varies directly with the aqueous solubility of the gas.

**Defences II. Immunologic Responses<sup>6,8</sup>**

When the lung is presented with an antigen, it produces an immunologic response consisting of local antibody production and cell mediated immunity. These mechanisms may act as the first line of defence to protect the mucus membrane against invasion by pathogens. In general, there is participation of both the humoral and cell mediated immunity analogous to that found in other tissues. There are several variables which affect the induction, expression, assessment and immune reactions in the respiratory tract. These include the particle size, dose and route of administration of antigen, the physicochemical properties of the antigen, the pulmonary constituents assayed for their immune response, the essay utilized to quantify the immune response and the contribution of systemic immune mechanisms to the local pulmonary immunity in health and disease. Immune mechanism is usually protective serving a host-defence function. Under certain circumstances the usually 'protective immune' reaction may become deleterious 'hyper sensitivity'. This is probably dependent upon the 'immunological reactivity' of the subject, the circumstances associated with the exposure to the antigen and the nature of the inhaled particle, *i.e.*, highly antigenic or relatively inert.

**Defences III : Pulmonary Reaction to Injury**

When the defence mechanisms described above fail to cope with the environmental pollutants, the inflammatory responses form the next line of defence. Inflammation is mediated by vascular response and inflammatory cellular exudate which vary with the noxious agent. Oedema is an important feature. Chemical irritants, such as war-gas, kerosene and high concentrations of oxygen cause cell injury and pulmonary oedema.

If the injury has been dealt with successfully, the resolution of inflammation is accomplished by clearing of inflammatory debris by scavenger cells (macrophages). Severe and/or prolonged injury may lead to permanent destruction of the lung tissue, often followed by scar formation (fibrosis).

## Air Pollution

The ambient air we breathe-in is a mixture of nitrogen and oxygen with minor constituents, like  $\text{CO}_2$  and trace gases. Pollutants are substances which are not normally present, e.g., dust, smoke, industrial and automobile exhaust, gaseous and particulate matter. The nature and amount of these pollutants vary from place to place depending upon the population and vehicular density, location of industrial units and other such factors.

Air pollution can be discussed under three headings :

(A) *Personal* : Tobacco smoking is the most important cause of pollution of the air which one breathes. The smoke contains a wide variety of gases and particles which are deleterious. Chronic non-specific respiratory disease, emphysema, lung cancer, coronary artery disease and peripheral vascular disease have been definitely shown to be associated with tobacco smoking. Tobacco smoking, however, is not the subject of our discussion.

(B) *Community Air Pollution* : i.e., urban or regional pollution. Some of the types and sources are :

- (a) Sulphur oxides, e.g., coal fired, electric power generation, industrial processes, etc.
- (b) Photochemical smogs (hydrocarbons, ozone, nitrogen oxides), e.g., from automobile exhaust. Much of the impact of air pollution on the lungs is caused by aerosols, i.e., particles suspended in air. Their physical properties determine how much is deposited and where. The physical (solubility) and chemical properties determine their biological effects. Ambient aerosols (those found in large communities) have a biomodal size distribution. The sulphur oxides, photochemical smog and trace metals are found in particles  $0.01\text{-}2 \mu\text{m}$  in diameter. Larger particles ( $2\text{--}100+\mu\text{m}$ ) tend to be mechanically produced like wind abrasion, and include soil and fine dust, sea salt, fly ash, silicon dioxide and calcium carbonate. These may create visibly 'dusty' air but are less likely to be deposited deep in the lung.

**(C) Occupational Pollution :** It is restricted to the workers of an occupation and the residents of the surrounding areas who are exposed for long periods. Dusty trades of mining, milling, grinding and sand blasting, etc. may be particularly prone.

**(D) Lung Problems due to Air Pollution :** The spectrum of functional and pathological responses of the lung to various kinds of exposures is wide. Chronic non-specific lung disease is the result of long term exposure to air pollution. Many of the occupational and environmental exposures can precipitate and/or aggravate asthma. Asthma can also be causally related to exposure in the working environment to air borne dusts gases or fumes, when it is termed as 'occupational asthma'. Organic dusts can also cause other allergic reactions producing allergic alveolitis. Inorganic dusts may produce variable patterns of fibrosis and occasionally neoplasms, on getting deposited in lungs. Smoke, noxious fumes and gases produce damage both to the airways and the alveoli of the lungs.

Some of the effects on lung of environmental exposures are discussed here :

### **1. Chronic Non-specific Lung Disease (Or Chronic Bronchitis)**

Chronic bronchitis is chronic inflammatory disease of the bronchi resulting in chronic cough, phlegm and/or breathlessness. Chronic bronchitis often leads to chronic respiratory insufficiency over a period of several years. Tobacco smoking is the commonest cause of chronic bronchitis. But it does occur in non-smokers. In Northern India, for example, chronic bronchitis is seen in above 20% adult male smokers and about 6% non-smokers.<sup>9</sup> Several factors may account for chronic bronchitis in non-smokers, e.g., exposure to general dusts and fumes, over crowding and extreme variations in temperature. Environmental dust is perhaps most important. Fine dust particles which are inhaled almost continuously in the bronchial tree cause chronic irritation and inflammation of the bronchial wall lining. This leads to scarring and also airways narrowing.

The content of environmental dust is very heavy in Indian towns and villages due to *kutcha* roads, violent wind storms,

open heaps of grains which are sifted frequently and exhaust of vehicular traffic and industry. Combustion of biomass fuels adds to this pollution (discussed separately).

In the city of Chandigarh where the ambient air pollution is minimal, chronic bronchitis is much less common; 0.6% in non-smoker men and 8.2% in male smokers. In non-smoking women, the incidence is slightly more (1.2%) which may be explained on the basis of the women being exposed to cooking fuels more than the men.<sup>18</sup>

More than the dust particles, these are the gaseous pollutants like oxides of nitrogen, sulphur oxides and ozone which act as irritants for the respiratory tract and promote the chronic inflammation of the airways.

Carbon mono-oxide is an important constituent of vehicular and industrial exhaust apart from tobacco smoking. The average carbon mono-oxide content in the home of a non-smoker is 2 ppm, while that of the outdoor air may be 3.5 ppm or more especially in heavy traffic areas. Protracted exposures to such elevated levels can increase the carboxy haemoglobin concentration in the blood causing impaired psychomotor function—the ability to perceive and react to stimuli like light and sound. Such impairment could be important for people driving the vehicles or operating the machines. Obviously the impaired ability to drive and operate is a risk for all. In Los Angeles, the atmospheric levels of carbon mono-oxide above about 8 ppm are associated with an increase in overall mortality rate.

Chronic exposure to elevated carbonmono-oxide levels could also be responsible for some chronic ailments like headaches, easy fatigability, pains in the legs and loss of memory. Atherosclerotic changes occur much earlier in these people. These effects, however, are likely to occur in those who are heavily exposed, e.g., smokers.

## 2. Biomass Fuel Combustion<sup>19-21</sup>

Over half the world's population use the biomass fuels as the only source of domestic energy for cooking and heating. Although in terms of total energy content the biomass fuels supply a relatively small fraction (10 %) of global energy

requirements, they provide the largest fraction of energy in terms of the number of people using them.

The biomass fuels include a wide range of materials. Crop residues such as rice, straw, coconut husk, cotton stalks, etc., dried dung from cattle, buffalo and camels, scrub plants weeds, cacti and other miscellaneous forms are used. The most important is fuelwood—logs, branches, bark, twigs and leaves.

Incomplete combustion increases the pollutant emissions dramatically. The biomass combustion produces high amounts of particulates, hydrocarbons and carbon mono-oxide. It is not a principal source of sulphur or nitrogen oxides. The suspended particulate matter are below 3 microns in diameter and thus respirable, i.e., penetrate and get deposited deep in the lung.

The acute effects of biomass smoke inhalation are largely due to asphyxiation and carbon mono-oxide. It could be life threatening causing rapid death. Chronic exposure produces irritative and inflammatory action. The emissions may also damage the respiratory tract mucous lining and the cilia thereby lowering the local defences and making more susceptible to infections. Acute infective bronchitis, bronchiolitis and pneumonias are common in those exposed to the fuels chronically, especially the children.

Chronic obstructive lung disease and chronic respiratory failure has been attributed to this exposure in several studies.<sup>13,14</sup> Sixty-six of 2,180 adult women (3%) had symptoms of chronic bronchitis in Chandigarh, the highest number being in those who used *chulla* for cooking.<sup>15</sup> In northern and central India, chronic cor pulmonale (heart failure due to chronic lung disease) accounts for 10-30% of hospital admissions and the male : female ratio is equal in contrast to other populations where M : F ratio are 5 : 1. Since women in this part of India do not generally smoke, domestic air pollution is thought to be an important cause.<sup>16</sup>

Several ingredients of biomass combustion emissions are potentially carcinogenic. The average benzazopyrine exposures found during cooking period in four villages in Western India were found to be 4000 ng/m<sup>3</sup>, which in terms of inhalation would be equivalent to smoking about 20 packs of cigarettes per day.<sup>17</sup> With these levels, a relationship with respiratory system cancers should be hardly surprising. Carcinoma of the naso-

pharynx has been shown to be commoner in high lands in Kenya where cooking is done indoors.<sup>18</sup> Association with lung cancer has not been worked out but we do suspect that air pollution due to biomass fuel combustion could be important.<sup>19,20</sup>

### 3. 'Second hand' Smoking

It is being increasingly recognized that tobacco smoke not only affects the smoker, but also those who live in the company of the smoker. This is due to the 'side stream' smoke released from the lightened end of cigarette/bidi when not being smoked. This is also called 'second-hand' or passive smoking. Respiratory infections are much more frequent in children of parents who smoke.<sup>21</sup> Lung functions of these children are also low as compared to the children of non-smokers.<sup>22</sup> Exposure to side stream smoke can cause cough and breathlessness in non-smoking subjects specially the patients of asthma, chronic bronchitis and emphysema.<sup>23</sup>

There are several studies which have convincingly shown an association of lung cancer and passive smoking.<sup>24-26</sup> Increased mortality due to lung cancer has been reported in non-smoking wives of smokers in Japan compared to control groups.<sup>24</sup> There are reports that side stream smoke actually contains even higher concentrations of noxious substances than does main stream smoke.<sup>27</sup> The reports that cigarette smoke contains radioactive palonium<sup>3-10</sup> derived from phosphate fertilizer could account for some of the carcinogenic risk to both the smokers and non-smokers.<sup>28</sup>

Since tobacco smoking is rather common and mostly uninhibited even at public places, it affects the health of all who are exposed to this environment.<sup>29</sup> It is possible that many a problems which are largely associated with tobacco smoking but which also occur in non-smokers as well, can actually be explained on the basis of second-hand smoking.

### 4. Environment and Asthma

In known asthmatics and hypersensitive individual, environment greatly influences and alters the clinical course of

the disease. Cold, dusty and smoky environment is bad for these individuals. Seasonal changes in the severity of asthmatic episodes is largely due to environmental alterations. The asthmatics are worse during the months of September to November when the atmosphere is full of antigens like pollen grains. Being the festival season and the onset of winter, people clean and white wash their houses. This raises the dust content of the air. They also take out warm clothes stored in the trunks and closets for long. This releases a lot of fine dust and mite in the air. These are highly allergenic. The open burning of paddy husk in the fields make the environment generally smoky. No doubt that the onset of winter is alarming especially for a patient with lung disease like asthma and chronic bronchitis.

### **5. Occupational Asthma**

When asthmatic episodes of bronchospasm are causally related to the exposure in the working environment to air borne dusts, gases or fumes, it is termed as occupational asthma. As early as 1713, Ramazzini, 'father of Industrial Medicine' had recognised grain dust asthma when he described, 'Diseases of sifters and measurers of grain'. Subsequently 'byssinosis' was described among cotton workers in 1877 and asthma caused by platinum salt exposure among photographic workers in 1911. Since then a number of work related asthmas have been recognized.

Occupational exposures can incite airway reactions either as specific or as non-specific stimuli. Chemical agents like SO<sub>2</sub> and chlorine, other agents like flour may induce asthma as non-specific stimuli. The term occupational asthma is restricted to asthma induced by hypersensitivity to an agent inhaled at work. A comprehensive list is given by Parkes,<sup>29</sup> is beyond the scope of this article. Some important chemical agents are diisocyanates (e.g., toluene, diphenylmethane, naphthalene, hexamethylene used in polyurethane foam manufacture, printing on flexible packaging, spray paints, etc.), acid anhydride (used as adhesives, surface coating), polyamines (as plastic coatings) and complex (34) platinum salts. There are several biological agents which can induce asthma, e.g., small mammal's (rats;

mice, rabbits, guine pigs) urine proteins, locusts; grain flour and contaminants like mite and mould. Most of these agents are recognized in Western countries for statutory compensation. The relative importance of different causes of occupational asthma depend upon both the risk to the exposed population and the size of the population at risk. An abbreviated list of occupational asthmas is given below:

Agent	Industries
<b>(a) Insects</b>	
Grain mite	Grain workers
Cockroach	Lab. workers
Locust	Research laboratories
<b>(b) Birds</b>	
Pigeon	Pigeon breeder
Chicken	Poultry workers
Budgerigar	Bird fanciers
<b>(c) Plants</b>	
Grain dust	Grain handlers
Wheat flour	Bakers, millers
<b>(d) Chemicals</b>	
Toluene diisocyanate	Polyurethane industry, plastics, varnish
Diphenyl methane diisocyanate	Foundries
Phthalic anhydride	Epoxy resins, plastics
<b>(e) Wood dust</b>	Carpentry, construction, wood making sawmill
<b>(f) Metals</b>	
Platinum	Platinum refinery
Nickel	Photographic workers, Metal plating
Chromium	Tanning
Cobalt	Hard metal industry

(Contd.)

Agent	Industries
(g) Drugs	
Pennicillins	Pharmaceuticals
Cephalosporins	-do-
Methyl dopa	-do-
Spiramycin	-do-
Salbutamol intermediate	-do-
Tetracycline	-do-
Amprolium Hcl	Poultry mixer
Sulphur chloramides	Manufacturers, brewery
(h) Others	
Ethylene diamine	Photography
Formalin	Hospital staff
Henna and persulphate salts	Hair dressing
Dioazonium salt	Photo copying and dye

## 6. Occupational Inorganic Dust Lung Diseases <sup>29,30</sup>

Several inorganic dusts like tin, talc and mica get accumulated in the lungs. These produce no functional impairment. Iron accumulation in arc welders may produce fine nodular densities, but no disability in function. These are non-fibrogenic dusts. In coal workers' lung (anthracosis), the lung function is generally normal. Any demonstrable chronic airflow obstruction in such patients is almost always due to associated tobacco smoking.

Some inorganic dusts are fibrogenic i.e., they incite reaction in the lung ultimately resulting in loss of function, respiratory disability and failure. Some are discussed below:

- (a) *Coal* <sup>31,32</sup> : In a small number of patients (less than 1%), pulmonary fibrosis may occur in the nodular area of coal deposit in the lung. Once fibrosis progresses, it may lead to respiratory failure.
- (b) *Silica* <sup>33,34</sup> : Silicon exposure occurs in miners, and in those working in silicon quarries. Silica particles are ingested by alveolar macrophages; they interact with and destroy the lysosomal membranes of the

macrophages killing the cells. The dying macrophages also release a 'fibrogenic factor'. Pathologically, there is nodular fibrosis in the lungs. Both obstructive and restrictive type of functional impairment occurs.

- (c) *Asbestosis*<sup>35-38</sup> : Since asbestos fibre is fire-resistant, it is commonly used in fire-proof roofing, bags, lamp wicks and other similar products. Asbestosis occurs in workers involved in these professions, and miners. The simplest reaction in the lungs to asbestos exposure is the formation of 'asbestos bodies'. There may occur interstitial fibrosis which is progressive. It may also produce inflammation, pigmentation and fibrosis of the walls of the small airways leading to airway obstruction. Asbestos exposure is also associated with pleural effusion, pleural fibrosis and plaques. Effusions are commonly recurrent, often asymptomatic and may be haemorrhagic. Malignant mesothelioma of the pleura and peritoneum are also seen. Lung cancer has also been related to asbestos exposure, especially in the smokers.

The following table briefly summarises the environmental and occupational agents and the pathological effects on the lungs:

Agent	Occupation at risk	Lung disease
(a) Iron, tin, coal, talc, mica	Arc welders, tin workers, coal miners, rubber workers	Dust deposition in the lungs with nil or minimal fibrosis.
(b) Silica, coal	Miners, quarriers	Nodular fibrosis
(c) Inorganic dusts	Dust exposed workers especially coal or silica	Massive fibrosis
(d) Asbestos, talc	Asbestos workers, talc miners, rubber workers	Interstitial fibrosis

(Contd.)

Agent	Occupation at risk	Lung disease
(e) Silica, other dusts	Massive silica exposure	Alveolar proteinosis
(f) Asbestos, silica, other dusts	Same as for asbestos, silica	Small airways disease
(g) Asbestos, chromium, nickel, arsenic etc.	Asbestos handlers, refinery workers, smelter workers	Neoplasms (Tumours)

### 7. Organic Dust Lung Diseases<sup>37,38</sup>

Exposure to organic matter like biological products, micro-organisms, fungi moulds and hay can produce different kinds of lung diseases. Occupational asthma and precipitation of asthmatics episodes has already been discussed. Lungs can also respond to the organic material by alveolitis usually called allergic alveolitis. This reaction may be acute in the form of interstitial pneumonitis presenting as an acute on coming pneumonia. Pneumonitis may be progressive leading on to fibrosis and ultimately respiratory failure.

Various types of lung disease have been described named according to the types of exposure. A brief Table is given below :

Organic matter	Antigen	Diseases
(a) Moldy hay	Micropolysora faeni Thermoactinomyces vulgaris	Farmer's lung
(b) Moldy sugarcane	T. Vulgaris or M. faeni	Baggassosis
(c) Mushroom compost	-do-	Mushroom Picker's disease.
(d) Dust from air-conditioner or furnace	-do-	Pneumonitis

(Contd.)

Organic matter	Antigen	Disease
(e) Moldy maple bark	Cryptostroma corticale	Maple bark disease
(f) Redwood dust	Graphium species	Sequoiosis
(g) Moldy cork dust		Suberosis
(h) Cheese particles	Penicillium caseii	Cheese washer's lung
(i) Paprika dust	Mucor stolonifer	Paprika splitter's lung
(j) Malt dust	Aspergillus clavatus	Malt worker's lung
(k) Avian dust	Avian proteins	Bird breeder's lung
(l) Pituitary powder	Bovine or porcine protein	Pituitary snuff taker's lung

It may be mentioned that although the incidence of these problem has not been well worked out from India, but these should be equally common. We found antibodies to Farmer's lung antigens in 50% of patients of non-specific chronic lung disease who were non-smokers.<sup>39</sup>

#### 8. Gases and Fumes <sup>30,40</sup>

The ghastly tragedy of Bhopal resulting in over 2,000 deaths due to the leakage of methyl diisocyanate gas from an Union Carbide fertilizer plant is too recent to be deliberated upon. This was perhaps the worst ever industrial disaster in the modern times and the most horrifying example of the effects of gases and fumes on human body especially the lungs. A large amount of any gas or smoke causes immediate death due to asphyxiation because of displacement of oxygen. If the gas is soluble and toxic, the enormity of the damage is obviously much more. Needless to say that the major cause of immediate death in any tragedy like the one at Bhopal is the lung damage due to asphyxiation and/or pulmonary oedema.

Death is only one extreme. The spectrum of damage due to gases and fumes varies from simple irritative cough, irritation of eyes and nose to severe pneumonias, pulmonary oedema, convulsions and coma. While here we are largely focusing our attention to the lungs, other organs including the liver, heart, brain and kidneys are involved either due to the resultant hypoxia or due to direct toxic effects of the gas.

Several gases and liquids in a finely dispersed state in the air reach the lungs. The damage depends upon the chemical composition of the gas, its solubility and the degree and duration of exposure. There are four main mechanisms by which the damage is caused :

(a) *Asphyxiation* : Even an otherwise non-toxic gas (e.g., carbon dioxide, nitrogen, methane) can displace oxygen from inspired air and cause asphyxiation.

Tissue asphyxia can also occur if the oxygen carrying capacity of the blood is reduced or the cellular respiratory enzyme system is poisoned. Carbon monoxide inhalation is a common example. Oxides of nitrogen may act similarly. Carbon monoxide concentrations are quite high where coal is burnt and CO poisoning is frequent in such situations especially in a closed surrounding.

(b) *Direct Mucosal and Alveolar Damage* : Toxic gases may injure the respiratory tract depending upon the physical and chemical properties, duration and concentration of the exposure. Highly soluble gases like ammonia and sulphur dioxide cause maximal injury to the proximal and large airways causing bronchitis, bronchiolitis, atelectasis and pneumonia. The less soluble gases (chlorine, oxides of nitrogen) may produce distal injury at alveolar level causing pneumonia, pulmonary oedema and severe respiratory distress.

(c) *Systemic Toxicity* : Inhalation of fumes of metal oxides (e.g., zinc, copper, magnesium, cadmium, nickel, tin, iron, selenium, antimony, manganese) may cause systemic reaction like fever and other constitutional symptoms besides respiratory symptoms. This is called 'metal fume fever'. This occurs, for example during welding of galvanized iron or during cleaning of zinc coated water tanks. 'Polymer fume fever', can occur due to inhalation of fumes of degradation products of polytetrafluoroethylene (Fluon, Teflon) when it is heated to high temperature.

(d) *Immunological Effects* : These are associated with a variety of inhaled vapours and fumes which may be sensitizers e.g., toluene diisocyanate (TC 1), diphenyl methane diisocyanate, platinum compounds. This has been discussed under 'occupational asthma' since the main problem which occurs on inhalation is 'bronchospasm'. In sensitized individuals even minute quantities may produce an acute episode of breathlessness and wheezing.

(e) *Post hoc* : What I have discussed is only a glimpse of what environment means to the human body as a whole and lungs in particular. Lungs are only a gateway for all these air borne pollutants. The magnitude of these problems in India is going to increase in view of modernization, increasing industrialization, urbanization and over crowding. Steps to counteract the hazards of environmental pollution must precede or at least run parallel to the speed of modernization. Failure to do the same is counter productive and ends up with a sick society unable to reap the benefits of modernization. It becomes self-defeating in purpose.

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## CHAPTER 6

# ***Effects of Water Pollution on Health***

*(A Study of River Water and Groundwater Pollution)*

GAUTAM MAHAJAN\*

## INTRODUCTION

Walker (1969) defined the groundwater pollution as an impairment of water quality by chemicals, heat or bacteria to a degree, that does not necessarily create an actual public health hazard, but does adversely affect such waters for domestic, farm, municipal or industrial use. The pollution can originate from a point or distributed sources within the recharge area of an aquifer. The rise of groundwater pollution is highest in urban areas where large volumes of wastes are concentrated into relatively small areas. The risk is further increased if they are located on areas of permeable surface deposits.

Further, the intensive use of natural resources and the large production of wastes in modern society often pose a threat to groundwater quality and already have resulted in many incidents of groundwater contamination. The groundwater moves very slowly, sometimes many years may lapse after the start of

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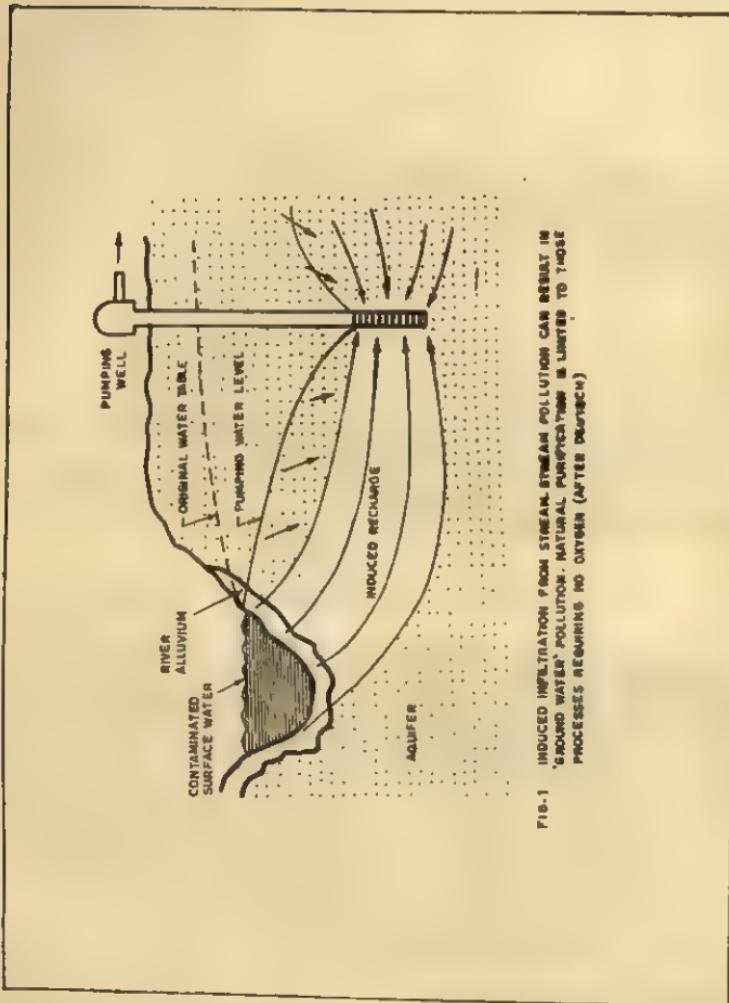
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pollution before affected water shows up in a well. Similarly, many years may be required to rehabilitate contaminated—aquifers, after the source of pollution has been eliminated. Sometimes this delay may force abandonment of wells and may require costly development of alternate water supplies. Prevention of contamination is thus, the best way for protecting groundwater quality. Slow movement of groundwater is favourable. Radioactive substances, bacteria and viruses may decrease with the passage of time. In such cases, long underground detention times may result, in removal of the undesired substances. Degradation of groundwater quality can take place over large areas from plane or diffuse sources like deep percolation from intensively farmed fields or it can be caused by point sources such as septic tanks, garbage disposal sites, cemeteries, mine spoils and oil spills or other accidental entry of pollutants, into the underground environment. A third possibility is contamination by poor quality water; like seepage from polluted streams or intrusion of salt water from oceans.

Major pollution sources in rivers and case histories of groundwater contamination are given below.

### SEWAGE AND INDUSTRIAL WATER

Large quantities of industrial and sewage wastes are disposed off into streams and rivers; the degree of dilution in dry periods being governed solely by the base flow of that river. Evidence of pollution has also been obtained by refuse tip percolates, which either flow into them as surface run-off, from discharges of porous land drains or from leaky culvert carrying water course under a tip. During prolonged dry periods the base flow becomes minimal causing reduced dilution. Indeed the base flow may cease completely and the river becomes impure. In areas where groundwater is extracted from aquifers in hydraulic contact with the river bed, induced infiltration of the river water can occur resulting from the establishment of influent conditions, and polluted water can, therefore, be drawn into the aquifer from surface streams (Fig. 1). In areas where groundwater is obtained by induced infiltration, it would be necessary to stop the discharge of wastes within the reach of influent see page



caused by abstraction and to ensure at all times that the base flow is adequate to provide the required dilution.

The sewage material enters the ground intentionally from septic tanks, cesspools and systems where sewage is applied to land for crop irrigation, ground recharge, or simply disposal. Unintentional entry of sewage into the underground environment includes leakage from sewers and seepage from sewage lagoons (Miller *et al.*, 1974) and seepage from streams or dry wastes in which sewage effluent is discharged.

### CHARACTERISTICS & COMPOSITION OF SEWAGE

The quality and thus the groundwater pollution potential of sewage depend on the type of treatment it has received before it enters the ground. Sewage that has not had any treatment is called raw sewage. Primary effluent is sewage that has received primary treatment, generally obtained by flowing raw sewage through a tank where everything that floats or sinks is removed. Secondary treatment is a biological process in which bacteria are used to digest dissolved and suspended organic waste matter, not removed by primary treatment. Secondary treatment is obtained by passing primary effluent through aerated tank (activated sludge process) or by sprinkling it on deep beds of rocks (trickling filters). Tertiary treatment consists of various physical, chemical and biochemical process including phosphate precipitation and chlorination or other disinfectants. Conventional primary and secondary treatment each removes 40 to 50% of organic waste matter expressed as BOD (Biochemical Oxygen Demand), yielding a total BOD removal of 80 to 90%. Secondary effluent, however, still contains more than half of N and P of raw sewage. Tertiary treatment is used where there are critical pollution problems in the receiving water or where sewage is to be reused.

### SEWAGE POLLUTION IN GANGA

The Ganga river system has been converted into a network of cesspools and drains by municipalities and industries. The Ganga despite its high self purification capacity is among India's most polluted rivers.

It drains the southern slopes of the Himalayas and part of the northern slopes of the Vindhya ranges, sweeping vast amounts of snow and rainfed water into the Bay of Bengal. The Ganga river system drains about a quarter of India's Land Areas.

Along every kilometre of the Ganga in Uttar Pradesh, Bihar and West Bengal, people and factories are pouring their garbage, excreta and muck into the river. None of large cities on the banks of the Ganga has a sewage treatment plant, although most of them have partial sewerage facilities. In all 48 class-I, 66 class-II towns dump largely untreated sewage into the river every day. To this is added the burden of other human activities like bathing, washing of clothes and immersing of ashes or unburnt corpses. A plan to spend Rs. 200 crores, to cleanse Ganga, is underway, by Central Ganga Authority.

### THE YAMUNA

Shockingly, high level of pollution exists along vast stretches of the Yamuna river also. Everyday its 48 km portion through Delhi, picks up nearly 200 million litres of untreated sewage. Two-third of Delhi's water supply is obtained from the river Yamuna at Wazirabad (64.4%) and Okhla (2.3%). Out of an estimated consumption of 1200 million litres per day (MLPD) almost 30%, 960 MLPD, is returned as waste water. The capacity at Delhi's sewage plants is inadequate, only 46.4% of the waste gets partial or full treatment. The rest, 515 MLPD, finds its way into the Yamuna, through city's 17 open drains. Almost 96% of Delhi's liquid waste is domestic sewage.

### SEWAGE TREATMENT

Sewage treatment has a long history and experience behind it. In 1977 Central Board for the Prevention and Control of Water Pollution, after a survey of pollution in Delhi, suggested three phase procedure for treating the untreated waste water of 515 MLPD (53.6% of total waste water). In Phase-I it has suggested that at least 5 of 7 major drains which discharge into the Agra canal can be chlorinated. Phase-II consists of low cost waste water treatment system being installed at the drain

out falls to treat the water to conform to the prescribed effluent standards. Phase-III provides for the seven major drains through appropriate sewage system followed by waste water treatment.

Treated sewage can be used for irrigation and pisciculture. It is only when pollution levels go beyond specific threshold levels that the waste water can no longer be used for productive purposes.

### DISEASES CAUSED FROM SEWAGE WATER

Disease causing bacteria in sewage includes bacteria of salmonella group (typhoid), shigella (bacillary dysentery), Mycobacterium (tuberculosis) and vibrio (cholera). Pathogenic viruses include enteraviruses, reoviruses, rotaviruses, adenoviruses and hepatitis viruses. The latter have caused many disease outbreaks. Viruses can cause a wide variety of diseases, including gastronenteritis, diarrhoea, respiratory illness, paralysis, heart diseases, meningitis, liver disease and various infections and rashes. They can also produce subclinical or latent infections. Other pathogens in sewage include protozoa, like entamoeba histolytica, and helminthic parasites such as ascaris and tape-worm ova (Bouwer and Chaney, 1974).

Sewage effluent contains multitude of other chemicals, including metal enzymes, hormones, bioc'des, phenols and other organic compounds. The city sewage in the State of Punjab is disposed of directly into the fields. Sewage through rich in nitrogen, may contain heavy metals as shown in Table 1.

**Table 1**

Location	Concentration (ug/ml)						Source
	Fe	Cu	Mn	An	Pb	Cd	
Abohar	1.6	0.09	0.10	0.14	0.03	0.01	
Bhatinda	2.9	0.35	0.14	0.20	0.04	0.01	S. Singh 1981
Jalandhar	5.3	0.37	0.23	0.38	0.09	0.015	
Amritsar	4.1	0.18	0.30	0.31	0.05	0.91	
Ludhiana	3.1	0.64	0.56	0.81	—	0.012	V.K. Verma

These heavy metals accumulate in soils and could attain toxic levels.

## POLLUTION FROM INDUSTRIAL WATER

### The Ganga

Industries contribute chemical effluents to the Ganga's pollution load. DDT, factories, tanneries, paper and pulp mills, petrochemical and fertilizer complexes, rubber factories and host of others use the river to get rid of their wastes. The threat of pollution from chemical fertilizers and pesticides appears to be relatively small but growing.

The CBPCWP investigation reveals that about 10 km upstream from Kanpur city, the Ganga water quality is satisfactory. It deteriorates sharply after the city's water intake, at the Bhairm Ghat pumping station, upon receiving sewage from the city and wastes from textile mills and tanneries. The brown colouration caused by tanning from these wastes persists up to Kishanpur village, more than 10 km down stream. There are number of waste water outfalls which discharge directly into the river in this stretch. In addition, there are discharges of condenser water from the power house of the Kanpur Electricity Supply Administration, the pollution from many bathing and burning ghats, and the effluents from J.K. Rajans.

A research team from Banaras Hindu University found that Ganga water at Allahabad, Varanasi and Patna can be considered good for drinking purposes during summer and winter seasons. It is unsafe during monsoon because of high amount of total dissolved salts in the water. The concentration of chloride was observed to be low, dissolved oxygen was near to saturation, the nitrogenous content was within the permissible limits, and the particles of hrytoplanktons and zooplanktons were present throughout the period of investigation. No residues of DDT and Dieldrin could be detected in any of the samples. These are particularly important findings as they indicate the relative cleanliness of Ganga water in an area, largely free of industrialisation where the river has to deal with only sewage discharges.

### The Yamuna

One of the major tributaries of the Yamuna is the Chambal river. The Chambal river is Rajasthan's biggest as well as most polluted river. Kota, the site of a fertilizer complex, an atomic power station, a thermal power unit and other industrial units add toxic effluents including urea, ammonia, chlorine, lead, mercury and other metals. Aquatic life has been destroyed. The Chambal's water is unfit for consumption as evidenced by the large number of cattle deaths.

A 35 km stretch of the Gomti receives about 180 MLPD of sewage and wastes from pulp and paper factories near Lucknow, every day. Also the river suffers heavy pollution near Dalmianagar, where effluents from paper, chemicals, cement and sugar factories are discharged into its waters. Many years ago, Carp fishes were eliminated here, along a 22 km zone. Discharge from paper mills and chemical units at Mirzapur (Bihar) are so toxic that the fish mortality rate is the highest recorded for an Indian river.

The Damodar river flows its 540 km course, first through mining belt of Bihar. It then receives effluents from chemical and metallurgical factories between Bokaro and Sindri including the Bokaro Steel Plant, a thermal power station and the Sindri fertilizer unit. The lower Damodar valley from Asansol to Durgapur is one of the most highly industrialized region in India. Seventy major industries and 250 coal mines are spread around Asansol alone. In terms of oxygen depletion, eight industrial units in Durgapur, dump wastes that are equivalent to the sewage from city of one million population. The river is heading towards ecological disaster (Predict A.V. Natarajan, B.B. Ghosh of the Central Indian Fisheries Research Institute in Calcutta).

In the State of Punjab the pollution is caused by the steel industry effluents, paper industry effluents, distillery effluents, tannery waste and sulphurdionide. In addition to above wastes there are other wastes from milk plant, food industries etc. which need proper attention, so that their disposal on the soil does not effect their productivity. In certain instances it has come to notice where the industries have been themselves victims of the pollution which they cause in their vicinity. The

infection of soap samples by actenomy-cetes Fungi and of oil-seed cape by aflotoxins are such examples.

A preliminary survey of various factories in Ludhiana has revealed that industries dealing with the manufacture of metallic products, where electroplating and acid treatments are important processes, result in greater discharge of heavy effluents.

### THE HYDROGEOLOGY OF GROUNDWATER POLLUTION

The hydrogeology plays a dominant control over the occurrence and movement of groundwater and the hydrogeologist must determine to a very considerable extent what happens to any pollutant that may be introduced into groundwater regime. The hydrogeologic factors which control groundwater movement will control the movement of pollutant, since this pollutant is subject to the same physical laws that control groundwater movement.

Generally the polluted water moves downward through a zone of aeration to saturated zone and then laterally to point of discharge. The natural direction and rate of such movements are generally dependent upon the Geology, although the artificial controls can alter rate and direction.

### ACCESS TO THE AQUIFER

The pollution can enter the aquifer by percolation through a zone of aeration, by infiltration and migration in the zone of saturation, by vertical inter aquifer leakage or by direct injection. Its movement and entry is influenced by a large number of geological conditions.

- (a) The topography of the land surface has an important influence. Generally the groundwater table levels follow the land surface but tend to iron out irregularities. For examples in a flat land bordered by higher land and not having an outlet, groundwater circulation will be slow. Under these conditions highly mineralised water can result. In hilly country water can percolate rapidly flushed from the aquifer.

(b) Geological movements such as dips, tilting, folding and warping, joint faults, fault zone have a marked influence on the water movement. Stratigraphy, not only in the sense of the sequence between different formation, but also stratification within individual formation can be helpful or harmful in problems of ground-water contamination. Sedimentary formations exhibit gradational changes, both horizontal and vertical, in the size and character of material deposited. Such changes determine the permeability, which effects the occurrence and movement of water through the media. Especially important is the fact that permeability in the vertical direction is commonly much less, than in the horizontal direction. This must be recognised when comparing the predominantly vertical fluid movement in the unsaturated zone and the horizontal movement in the saturated zone.

Shallow aquifers are most susceptible to contamination, since they may be either in direct contact with surface sources of pollution or because there is little or no natural treatment afforded by the overlying strata. The risk of pollution of deeply buried aquifers, is less, but if dispersion and dilution of an organic and non-degradable pollutants is insufficient, protection has to be provided. Confined aquifers are comparatively the safest, since they are effectively sealed by impermeable layers.

Infiltration is the process by which a fluid is introduced into a medium through the medium surface, or through relatively shallow access point. It is caused by rainfall irrigation, liquid waste disposal, groundwater recharge and by seepage and leakage from streams and rivers (Fig. 2).

If the intensity of application is at all times lower than the saturated hydraulic conductivity of the medium will absorb the fluid without ever reaching saturation, and the wetted profile will attain a moisture content for which the conductivity is equal to the fluid application rate. The lower the rate, the lower the degree of saturation. If the intensity of application is less than the initial final value, the medium but greater than the fluid at less than its potential rate and the flow

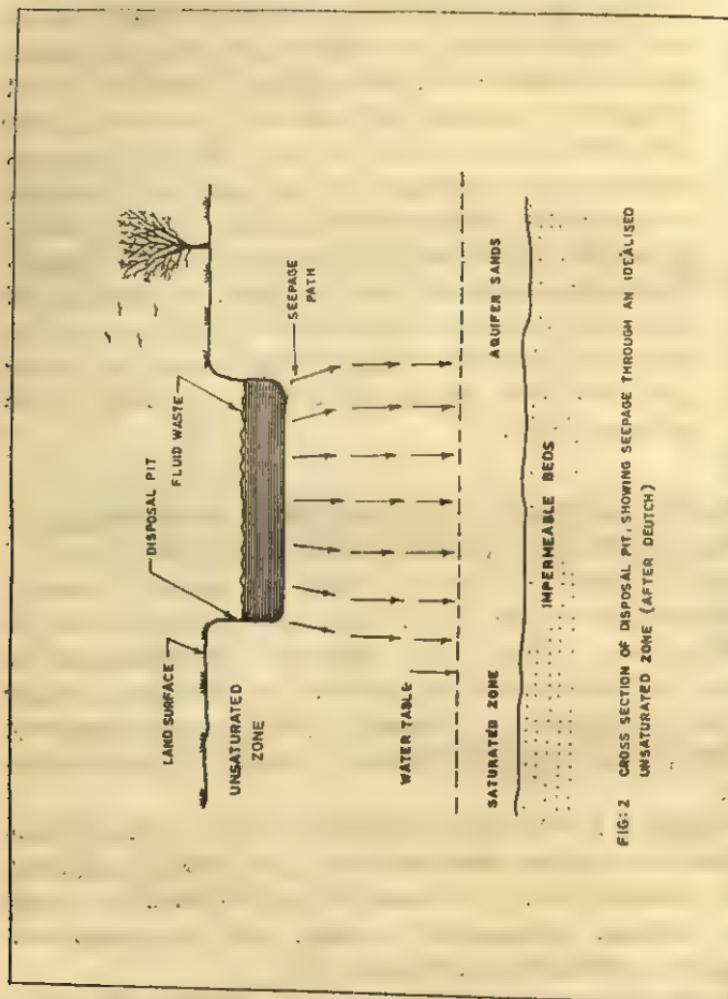


FIG: 2 CROSS SECTION OF DISPOSAL PIT, SHOWING SEEPAGE THROUGH AN IDEALISED UNSATURATED ZONE (AFTER DEUTCH)

decreases the medium surface will become saturated conditions. If the intensity of application is greater than soil infiltrability, the infiltration is also as for ponded applications. When the relation between the moisture profile can be calculated.

Infiltration into layered media in the case of a coarse layer overlying a finger textured layer is first controlled by the coarse layer. Therefore, in the long run it is the layer of lowest conductivity which controls the flow. If the infiltration continues for long enough positive heads develop above the boundary with the finer layer. In the opposite situation the initial infiltration rate is determined by the upper layer. However, as the front reaches the coarser layer the infiltration rate can decrease. This is because water at the wetting front is normally under tension and this tension may be due to high permit entry into the relatively larger pores of the coarse medium. The lower layer can never become saturated, permeable layer cannot sustain the flow at the saturated hydraulic conductivity of the lower coarse layer.

Aquifer use can cause lateral and vertical inter-aquifer movement. This can be caused by bore holes producing a reversal of natural gradients and diverting polluted water into the aquifer. It can also produce pressure reductions around pumping wells which causes encroachment upwards for example saline or connate water. Aquifer use can also cause salt water encroachment (Fig. 3).

### CASE STUDY IN PUNJAB

Groundwater pollution has been observed in various industrial towns in the State of Punjab. The quality of groundwater in some of these towns has been studied. The industrial units are discharging their effluents on the surface which through seepage reaches the groundwater reservoir. Budha Nala in Ludhiana town which runs through the town for a stretch of about nine kilometres forms the main source for the disposal of domestic and industrial waste through seven small *nalas* entering into it from various parts of the town. Around Budha Nala water table is ranging from 3.0 to 4.0 metres below ground level. In the area the surface clay is very thin ranging from 2.0 to 3.0 metres and the strata mainly consists of sand which being

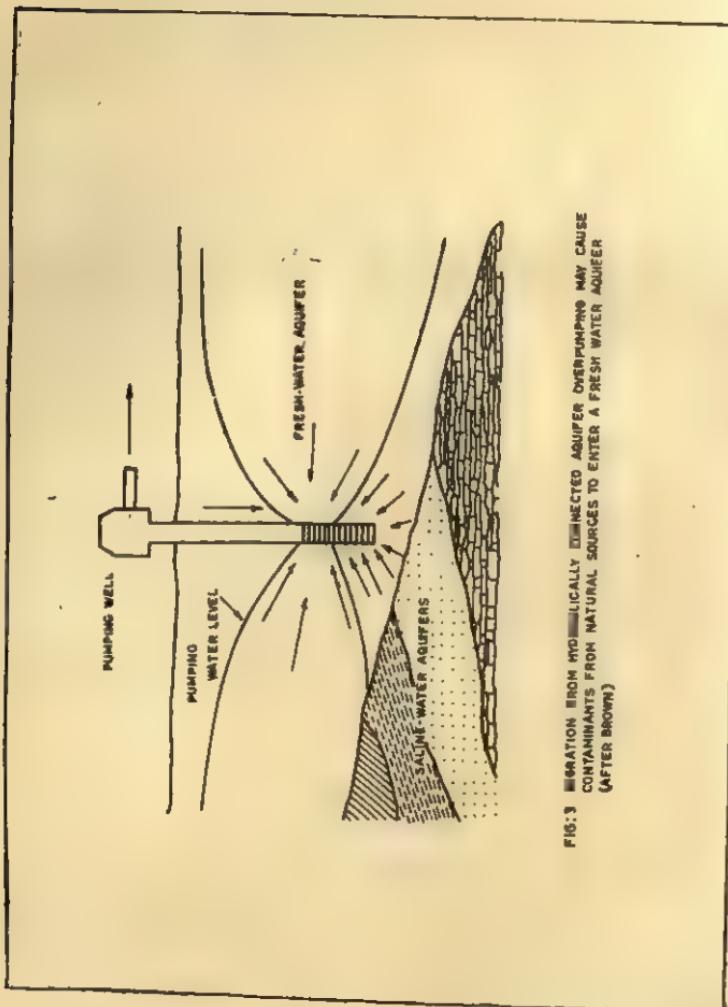


FIG: 3 MIGRATION FROM NATURALLY CONTAMINATED SOURCES OF CONTAMINANTS FROM NATURAL SOURCES TO ENTER A FRESH WATER AQUIFER  
(AFTER BROWN)

highly permeable, the wastes directly intercept the groundwater reservoir and pollute it (Fig. 4).

The results of the samples collected from Budha Nala indicate that there is a high degree of oxygen depletion and D.O. varies from 0.2 to 8.7 mg/l. B.O.D. Also increases in regular pattern from 7.6 to 39.2 mg/l. Nitrate contents are low in the upper reaches but go on increasing as we move away from Budha Nala (Table 2 and Fig. 5).

**Table 2 : Analytical Results of Water Samples from Budha Nala (Ludhiana)**

Particulars	Site 1	Site 2	Site 3	Site 4	Site 5
Pb	7.2	7.1	6.7	7.25	7.1
Total dissolved Solids	460	620	700	750	790
Alkalinity	384	378	402	624	433
Chloride	17.0	39	18.4	42.6	49.2
Sulphate	15	24	40	45	38
Total Hardness as Ca CO <sub>3</sub>	238	282	346	272	258
Biochemical Oxygen demand for 5 days at 20°C.	7.6	14.4	24.0	26.4	39.2
Dissolved	8.6	0.4	1.75	0.2	0.1
Oxygen Nitrate	Traces	3.15	3.15	5.90	5.5

All units except pH are in mg/l. (After M.R. Goyal *et. al.*, 1981).

In the industrial area of Ludhiana Town (Fig. 5) water samples taken from hand pumps have high concentrations to trace elements. The water samples are found to contain, chromium, copper, zinc and iron, etc. ranging from 0.05 to 1.75 mg/l, 0.04 to 0.16 mg/l, 0.05 to 0.17 mg/l, 0.71 to 4.0 mg/l, respectively (Table 2).

Alarmingly high concentrations of cyanide—concentration ranging from 1.6 to 2.0 ppm have been reported in the groundwater in area around cycle industries. It is evident that such water would have highly detrimental effect on the health of the people if the water is used for drinking purposes (Goyal *et al.*, 1981).

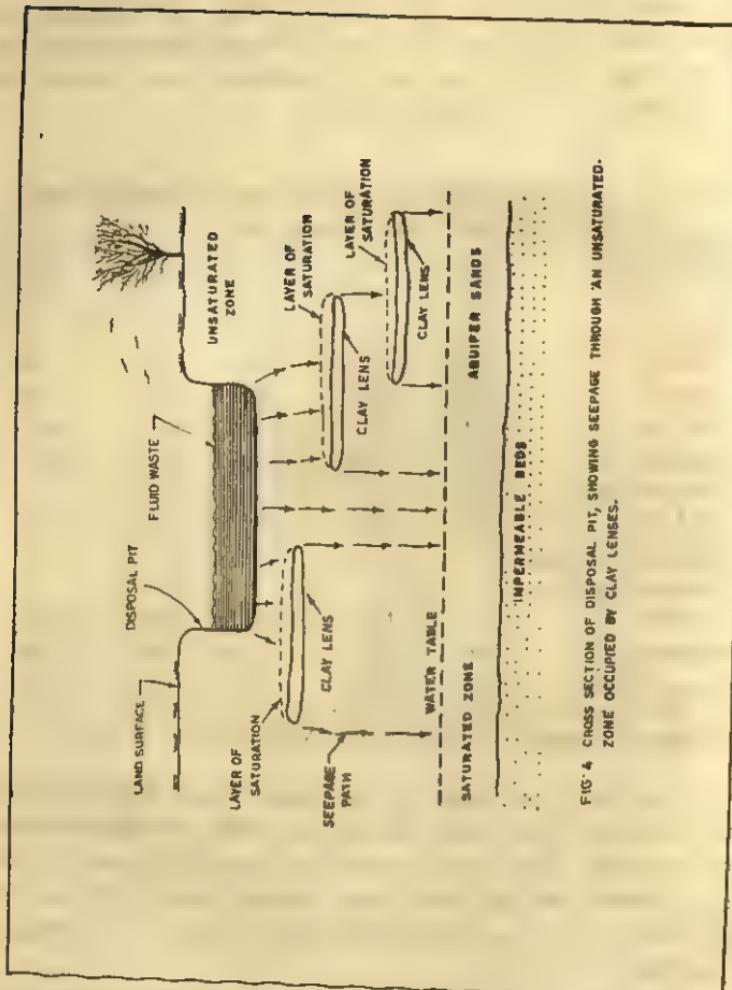


FIG. 4. CROSS SECTION OF DISPOSAL PIT, SHOWING SEEPAGE THROUGH AN UNSATURATED ZONE OCCUPIED BY CLAY LENSES.

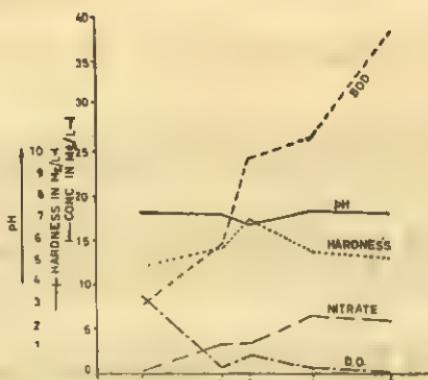


FIG. 5 VARIATION OF QUALITY CHARACTERISTICS BUDNA NALA (LUDHIANA)

In Hamira town of district Kapurthala, serious pollution of groundwater has been observed in the village around the distillery. Effluents from the distillery containing 3,000 to 4,500 ppm of B.O.D. are being discharged into the groundwater resulting in deterioration of the groundwater quality.

A pollution of groundwater has also been observed in the village on Amritsar-Verka Road due to the waste from the milk plant. The surface water in Batala town is also being effected due to industrialisation. The industrial wastes are affecting the groundwater in Tobri Area of Jalandhar district.

Table 3 : Analytical Results of Representative Water Samples of Ludhiana Town

Site	pH	TDS	D.O.	Akali nity	No. <sub>s</sub>	Total hard- ness	Fe	Cr	Cu	Zn
Ram Lila Ground	6.7	810	3.4	625	3,65	387	1.46	-	-	-
Near Budha Nala	6.7	620	4.1	646	2.80	374	1.00	-	-	-
Chhawni Mohalla	7.4	1000	4.4	448	25.00	360	1.46	-	-	-
Haibowal	7.5	520	Tr	408	18.00	328	1.22	-	-	-
Gobind Nagar	7.3	710	4.8	424	9.00	344	0.71	-	-	-
Daymand Road	7.05	890	2.8	366	36.50	435	1.22	-	-	-
Ashok Nagar	7.35	720	3.6	323	59.00	404	1.46	-	-	-
Jawahar Nagar	7.60	550	4.2	842	25.00	223	1.00	-	-	-
Dholewali Chowk	7.10	1,100	3.2	842	25.00	223	2.30	-	-	-
Ambala Road	6.80	1,400	Tr	702	9.00	280	4.00	0.05	0.05	0.06
Oswal Woollen Mills	7.10	1,400	1.4	433	31.50	629	1.22	1.75	0.05	0.07
Avon Cycles	7.10	800	5.4	579	36.50	278	1.22	0.07	0.16	0.17
Chandari Kalan	7.10	1,050	4.6	457	87.00	415	1.46	-	-	-
Gill Road	7.25	900	3.4	444	29.00	193	1.00	-	0.04	0.05
Brown Road	7.25	790	5.7	353	50.00	210	0.71	-	-	-
Samra Road	6.80	1,500	5.4	522	91.00	286	0.71	-	-	-

All units except pH are in mg/l. Tr. Traces. (Goyal *et al.*, 1981).

Similar effects are also being found in fast developing industrial towns like Phagwara, Goraya and Rajpura.

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## CHAPTER 7

# ***Environmental Impact of Heavy Metals on Health***

*(An Analysis of Food, Water, Air and Blood Samples)*

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### **ABSTRACT**

Toxic manifestations of heavy metals namely cadmium, lead, mercury and arsenic are well known. These metals have the capacity to effect adversely the activity of a living organism, its growth, health, life span and reproductive performance (Perry *et al.*, 1974). Industrial activities have disturbed geological catches of heavy metals and have released high concentrations of these metals into the environment. Consequently, man and animals are constantly exposed to heavy metals at an alarming rate. The present study was conducted in order to assess the existing levels of Cd, Zn, Cu, Cr, Mn, Pb and Ni in samples of air, water, food and blood collected from various sites of Himachal Pradesh, Chandigarh, Haryana and Punjab.

A significant increase in Cr and Zn levels was observed in water collected from Ludhiana and Parwanoo; two highly

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industrialized towns of Punjab and Himachal Pradesh respectively. Only slight variation was observed in case of Mn, Ni Cu and Pb. Increased Mn, Zn and Cd content was observed in air samples from Ludhiana as compared to other rural areas of Punjab. Much variation was not seen in the heavy metal content of food samples collected from different regions. Unexpectedly Morni hills of Haryana showed a slightly high levels of cadmium in water and blood samples. High levels of Cd were also observed in blood samples collected from Ludhiana. However, no significant change was observed in Pb content of blood samples collected from North India.

### **Introduction**

Metals are an intrinsic component of earth's crust. With the rapid development, the evolution of metal based industries has led to the contamination of environment with heavy metals. This has led to the increased exposure of man and ecosystem to the toxic levels thus presenting a potential health hazard to man as well as wild life. The present study provides a preliminary data regarding accumulation of Cd, Zn, Cu, Pb, Ni, Mn and Cr in industrial towns of North India in comparison to the rural areas and unexposed cities.

### **Materials and Methods**

Twenty samples of air, food, water and blood were collected from urban and rural areas of Punjab, Haryana and Himachal Pradesh.

#### **Sampling of Air**

Air sampling was carried out by drawing air through a filter medium (glass fibre filter) which retained practically all the particulate matter. High volume samplers with a flow rate of  $1-2\text{m}^3$  air/min were used. Sampling was carried out over a period of 24 hours. What man EPM 2,000 glass micro fibre filter papers were used.

### **Sampling of Water**

Water samples from rivers, lakes, reservoirs, open wells, tube-wells and taps were collected in metal free polythene containers of 1 litre. Five ml concentrated nitric acid was added to 1000 ml of samples at the time of sample collection to prevent precipitation and to minimise absorption losses or metals on the container walls.

### **Sampling of Food**

Food samples were collected in polythene bags. Food samples of lunch and dinner were taken separately. One fifth of food consumed by an individual was collected containing all the constituents. Wet weight of food samples were recorded at the time of sampling. Food samples were stored at  $-20^{\circ}\text{C}$ .

### **Sampling of Blood**

Blood samples were collected intravenously. Sterilized plastic disposable syringes and needles were used. The samples collected were stored at  $-20^{\circ}\text{C}$ .

### **Analytical Methods**

*Food samples* : After taking the wet weight of the sample, the samples were dried at  $70^{\circ}\text{C}$  in an oven for 24 hours. The samples were grind into a fine powder with the help of a blender and filtered through fine sieve.

Two gm of powdered food sample was digested in 15 ml of digestion mixture (nitric acid and perchloric acid in the ratio of 3 : 1). The samples were reconstituted and the final volume made to 25 ml. Blanks were also run with same procedure. The samples were analysed on DCP Atomic Emission Spectrophotometer, Spectra Span V, Beckman. The results were expressed as  $\mu\text{g/g}$ .

*Blood samples* : 0.5 ml of blood from human volunteers was collected and the samples were subjected to slow digestion in 5ml of conc.  $\text{HNO}_3$ . The volume was reduced approximately to 0.5ml. Hydrogen peroxide (0.4 ml of 30%) was added to

each sample and the samples were heated to dryness. The residue obtained was then redissolved in 2ml of 1% HNO<sub>3</sub> (v/v). Ten  $\mu\text{l}$  of the sample was analysed by Heated Grafite analyser fitted on Atomic Absorption Spectrophotometer, Perkin Elmer 4000. The results were expressed as  $\mu\text{g}/\text{ml}$  of blood.

*Air samples* : 2.5"  $\times$  5" of the glass fiber filtre was used for extraction by Soxhlet apparatus. After the extraction, the samples were reconstituted in 4N HCl and the final volume was made to 60 ml. The samples were analysed for Cd using DCP atomic Emission Spectrophotometer, Spectra Span V, Beckman. The results were expressed  $\mu\text{g}/\text{m}^3$ .

*Water samples* : No pre-digestion was done and the collected samples were directly analysed on DCP Atomic Emission Spectrometer, Spectra span V, Beckman. The results were expressed as  $\mu\text{g}/\text{ml}$ .

## Results and Discussion

A significant increase in Cr and Zn levels was observed in water collected from Ludhiana and Parwanoo, the industrialized towns of Punjab and Himachal Pradesh respectively (Table 1). Slight increase in Cd values were also observed in water samples collected from Ludhiana, Parwanoo, Faridabad and Morni Hills (Table 1). Increased amounts of heavy metals could be due to the contamination of the water either by industrial discharges or by the metal or plastic pipes used in distribution of drinking water (Schroeder, *et al.*, 1967). High Cd content in water from Morni Hills (Haryana) could be because of underlying rocks rich in Cd content. This hypothesis needs to be tested. The blood samples from this place also showed elevated levels of Cd (Table 4).

Food sample collected from different regions did not show any significant change in levels of Zn, Cu, Ni, Mn, Cr, Pb and Cd (Table 2).

Increased Mn, Zn and Cd content was observed in air samples collected from Ludhiana (Punjab) as compared to other rural areas of Punjab (Table 3). Air-borne heavy metal concentrations are typically dependent upon the nature and proximity of the local sources (Williams and Harrison, 1984).

The blood samples collected from industrial areas of Punjab

**Table I : Heavy Metal Concentrations in Drinking Water ( $\mu\text{g}/\text{ml}$ )**

Ele- ment	Chandigarh Rural	Punjab Rural	Haryana Morni (Rural)	Himachal Pradesh Chail (Rural)	Chandigarh U.T. (Urban)	Punjab Ludhiana (Urban)	Haryana Faridabad (Urban)	Himachal Pradesh Parwanoo
Zn	313(2—194)	583(ND—2170)	31(ND—333)	95(1—532)	214(ND—735)	1457(9—7670)	14.7(3—97)	700(9—5110)
Cu	83(ND—559)	9.5(2—61)	5.6(3—16)	14.1(4—121)	31(ND—245)	12(ND—57)	5(ND—20)	4.3(ND—12)
Cd	4.7(2—9)	4.8(ND—8)	7.1(2—15)	3(ND—8)	2.3(ND—5)	5.3(ND—15)	52(14—237)	13(ND—120)
Pb	32(3—136)	33(18—317)	27(19—44)	9(3—21)	26(3—40)	32(6—88)	13(3—37)	26.1(10—60)
Ni	42(33—48)	23(11—122)	8.3(3—34)	14(3—155)	54(50—58)	29(6—373)	41(16—110)	10(2—49)
Mn	106(30—413)	3.9(ND—24)	60(1—1160)	36(ND—671)	58(10—358)	3.7(ND—11)	51(7—274)	5.8(2—9)
Cr	2.3(ND—5)	22(5—205)	18.4(4—86)	12(ND—102)	11(5—51)	104(4—1610)	522(1—5610)	264(5—2040)

ND = Not detected.

Mean (Range); No. of samples—20.

**Table 2 : Zinc, Copper, Cadmium, Lead, Nickel, Manganese and Chromium Levels in Food Collected from Different Regions of North India ( $\mu\text{g/g}$ )**

Ele- ment	Punjab (Rural)	Haryana Morai (Rural)	Himachal Pradesh Chail (Rural)	Punjab Ludhiana (Urban)	Himachal Pradesh Parwanoo (Urban)
Zn	31.40(16.57—97.27)	36.29(7.30—113.32)	24.31(13.87—38.70)	23.99(6.21—41.02)	30.12(12.07—86.92)
Cu	34.65(16.98—87.48)	29.11(11.41—75.18)	13.11(2.46—31.08)	22.96(5.98—50.58)	11.84(3.43—39.63)
Cd	ND	ND	ND	ND	ND
Pb	4.35(ND—42.15)	6.65(ND—78.04)	18.18(1.63—60.6)	4.60(0.195—10.8)	26.34(3.15—61.5)
Ni	11.07(1.59—76.8)	17.19(3.22—57.45)	1.56(0.675—2.79)	18.03(1.17—57.9)	1.97(0.76—5.05)
Mn	77.72(ND—148.05)	12.62(0.34—63.3)	48.47(12.9—86.4)	—	43.50(26.55—103.8)
Cr	13.65(1.29—69.75)	25.34(ND—139.35)	5.81(3.61—8.07)	28.64(0.675—129.15)	7.78(4.23—18.00)

ND = Not detected

Mean (Range); number of samples = 20.

**Table 3 : Zinc, Copper, Cadmium, Lead, Nickel, Manganese and Chromium Levels in Air Collected from Different Regions of North India**

Element	Punjab villages (Rural)	Himachal Pradesh Morni (Rural)	Chandigarh U.T. (Urban)	Punjab Ludhiana (Urban)
Zn ( $\mu\text{g}/\text{m}^3$ )	0.647 (0.108—4.064)	0.154 (ND—0.273)	0.241 (ND—1.489)	2.721 (0.484—8.549)
Cu ( $\mu\text{g}/\text{m}^3$ )	1.182 (0.333—3.779)	0.613 (0.052—1.866)	0.506 (0.068—1.477)	0.662 (0.208—2.682)
Cd ( $\mu\text{g}/\text{m}^3$ )	ND	ND	0.62 (ND—1.2)	2.34 (0.33—21.00)
Pb ( $\mu\text{g}/\text{m}^3$ )	0.267 (0.086—0.886)	0.118 (0.017—0.310)	0.138 (0.025—0.274)	0.563 (0.211—1.677)
Ni ( $\mu\text{g}/\text{m}^3$ )	0.169 (0.042—1.051)	0.017 (0.003—0.054)	0.030 (0.012—0.079)	0.149 (0.044—0.321)
Mn ( $\mu\text{g}/\text{m}^3$ )	0.524 (0.133—0.976)	0.042 (0.012—0.111)	0.104 (0.027—0.218)	0.933 (0.259—3.259)
Cr ( $\mu\text{g}/\text{m}^3$ )	0.065 (0.022—0.102)	5.45 (ND—15.0)	0.025 (0.011—0.061)	0.092 (0.025—0.194)

ND=Not detected; Mean (Range); number of samples—20.

**Table 4 : Cadmium and Lead Levels in Blood of Human Adults from Different Regions of North India ( $\mu\text{g}/\text{L}$ )**

Site	Cd ( $\mu\text{g}/\text{L}$ ) Mean Range	Pb ( $\mu\text{g}/\text{L}$ ) Mean Range
Chandigarh (Rural)	0.081 (ND—0.713)	113.04 (71.04—175.23)
Haryana Morni (Rural)	1.104 (0.108—2.813)	159.86 (61.77—296.86)
Himachal Pradesh Chail (Rural)	0.261 (ND—1.312)	113.41 (60.97—159.84)
Chandigarh (U.T) (Urban)	0.994 (ND—1.918)	—
Himachal Pradesh Parwanoo (Urban)	1.183 (0.813—3.213)	158.03 (102.41—285.93)
Haryana Faridabad (Urban)	1.105 (0.518—1.813)	117.69 (82.72—165.45)
Punjab Ludhiana (Urban)	2.372 (0.032—3.744)	*143.00 (ND—710)

ND=Not detected, number of samples—20.

\*Analysed on DCP.

and Haryana showed increased Cd content reflecting increased industrial activity. However, no significant change was observed in Pb content of these blood samples. Cadmium concentrations in blood are probably related partly to body burden and partly to more recent exposure (WHO, 1980). Thus, it can be concluded that the atmosphere plays an important role in the dispersal of heavy metals within the environment. Sink processes for these trace metals are hot and dry deposition which leads to the enrichment of soil, vegetation and surface waters by these heavy metals. The atmospheric source may provide an important input into these media and consequently contribute to human exposure through water and possibly food as well as more directly by the breathing of polluted air.

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## CHAPTER 8

# *Environment, Cancer and Its Treatment*

*(Role of Radiotherapy)*

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In general several environmental agents are known to cause cancer in specific organs of the body. The list of well established causes include tar, ionising radiations (X-ray, radium) and sunlight, if the contact is intense enough and long enough. Aromatic amines used in the manufacture of synthetic dyes cause cancer of the urinary bladder. Radium and other radioactive elements produce cancer of bone. All types of injury continued over a period of time often initiate cancer; for instance the jagged edge of a broken bone/tooth rubbing against the soft tissue/tongue. Some types of cancers are peculiar to India due to social environment of customs and usages. In the Godavari region of Andhra Pradesh many persons are in the habit of smoking a locally rolled cigar with the burning end inside the mouth; resulting in ulcer and eventual cancer. The Kangri cancer of Kashmir is well known, due to persistent thermal trauma. In South-West India, the *dhoti* worn by men and women is tightly knotted at the waist; resulting in

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cancer of the part in many cases. Smoking, chewing, and inhaling of tobacco has a significant association with the development of cancer. Similarly chewing of tobacco, *pan* or betel nut has a relation with the precancerous changes. High calorie diet, increase in body weight, specially in the elderly men has relation to cancer occurrence. A Table showing the known cause of cancer is given below. (see Table 1)

**Table 1 : Known Causes of Cancer**

Agent or circumstance	Site of cancer
Aflatoxin	Liver
Alcoholic drinks	Mouth, pharynx, larynx, oesophagus, liver
Alkylating agents:	
Cyclophosphamide	Bladder
Melphalan	Marrow
Aromatic amines:	
4 Aminodiphenyl	Bladder
Benzidine	Bladder
2 Naphthylamine	Bladder
Arsenic (certain compounds only)	Skin, lung
Asbestos	Lung, pleura, peritoneum
Benzene	Marrow
Bis(chloromethyl) ether	Lung
Busulphan	Marrow
Cadmium (certain compounds only)	Prostate
Chewing (betel, tobacco, lime)	Mouth
Chromium (certain compounds only)	Lung
Chlornaphazine	Bladder
Chlorophenol/phenoxy acids	Sarcoma, lymphoma

(Contd.)

Agent or circumstance	Site of cancer
Furniture manufacture (hardwood)	Nasal sinuses
Immunosuppressive drugs	Reticuloendothelial system
Ionizing radiations	Marrow and probably all other sites
Isopropyl alcohol manufacture	Nasal sinuses
Leather goods manufacture	Nasal sinuses
Mustard gas	Larynx, lung
Nickel (certain compounds only)	Nasal sinuses, lung
Estrogens:	
Unopposed	Endometrium
Transplacental (DES)	Vagina
Overnutrition (causing obesity)	Endometrium, gallbladder
Phenacetin	Kidney (pelvis)
Polycyclic hydrocarbons	Skin, scrotum, lung
Reproductive history:	
Late age at first pregnancy	Breast
Zero or low parity	Ovary
Parasites:	
Schistosoma haematobium	Bladder
Chlonorchis sinensis	Liver (cholangioma)
Sexual promiscuity	Cervix uteri
Steroids:	
Anabolic (oxymetholone)	Liver
Contraceptive	Liver (hamartoma)
Tobacco smoking	Mouth, pharynx, larynx, lung, oesophagus, bladder
UV light	Skin, lip
Viryl chloride	Liver (angiosarcoma)
Virus (hepatitis B)	Liver (hepatoma)

Adapted from R. Doll and R. Peto, *Journal of the US National Cancer Institute*, June 19.

Whereas radioactive substances are known to stimulate the causation of cancer, the role of radiotherapy in the treatment of cancer is laudable. In this chapter role of radiotherapy in the treatment of cancer is discussed.

Radiotherapy has made great contributions in cancer cure with the introduction of megavoltage technology which has produced remarkable success in many forms of cancer with that of deep X-ray therapy (also known as conventional) which was practised for almost fifty years from its invention. Cobalt therapy (with discovery of artificial radioactive cobalt sources) in 1954-55 and linear accelerator with high energy X-rays in early 60's have changed the entire clinical practice of Radiotherapy in the conquest on cancer. Table 2 depicts the revolution in Radiotherapy in cancer management.

The main advantage with megavoltage therapy is that a high dose delivery is feasible in the target volume and the

**Table 2 : Conquest on Cancer Revolution in Radiotherapy in Cancer Management**

Sl. No.	Type of cancer	5 years	5 years	5 years
		survival % Deep X-ray	survival % Cobalt	survival % High Energy accelerators
1.	Hodgkin's disease	30-35	55-60	70-75
2.	Cancer of the cervix	35-45	50-55	60-65
3.	Cancer of the prostate	5-15	40-45	55-60
4.	Cancer of the Nasopharynx	20-25	30-35	45-50
5.	Cancer of the bladder	0-5	25-30	40-45
6.	Cancer of the ovary	15-20	35-40	50-60
7.	Retinoblastoma	30-40	45-55	80-85
8.	Seminoma of Testis	65-70	75-80	90-95
9.	Cancer of the tonsil	25-30	40-50	55-65

- (a) Conquest on cancer—US Senate Report by Prof. Fowler based on different series in published literature.
- (b) Patterns of Case Study : A nation-wide evaluation of the practice of Radiation therapy in cancer management. *Int. J. Radiation Oncology Biol. Phys.* by Cramer, S. and Herring, D. (1976).

surrounding normal structures receive dose well within their normal limits. The tolerance of the patient increases manifold since the skin reactions are minimal and absorption of radiation into the bone is negligible. These qualities have made megavoltage therapy a primary treatment in many forms of cancer.

The invention of artificial sealed radioactive isotopes has made significant improvement in internal radiation where these isotopes in the form of tubes and needles are inserted in and around the tumours. The radium which was discovered in 1898 and was in use for internal radiation therapy since 1903 was replaced with the introduction of artificial isotopes. The most important of them are Caesium-137, Iridium-192 and Iodine-125 and are known as radium substitutes. These isotopes have less radiation hazards than that of radium and have been used extensively since the beginning of 1970. The most important advantages by the internal radiation with sealed isotopes are limited radiation to the desired volume and they are safe for patients as well as to the physicians and medical technologists. The recent introduction of after-loading techniques in the use of sealed radioactive isotopes has further improved the radiation dosimetry and accuracy in the treatment planning. The radium which has served almost more than 50 years is now completely replaced by these isotopes since they are more safe and produce desired dose in the target volume for more cure.

In recent years, the introduction of heavy particle radiation therapy with Neutron, and Protron and Pi-meson have further given a new hope in cancer cure. The main advantages of heavy particle therapy that (a) they kill more hypoxic cells than that of megavoltage therapy, (b) there is practically no fluctuation of radiosensitivity throughout the cell cycle (please note that in megavoltage therapy and isotope radiation the cell is more than sensitive in mitotic phase), and (c) increase biological effectiveness. The total advantages of this form of radiation is to improve local control of cancer. There have been reports of improvement in cure in some form of cancer especially related to head and neck region and salivary gland tumours. However, the clinical practice of particle radiation therapy is under investigation. The physics and dosimetry is also in investigation for clinical use.

The frequency of radiotherapy as a primary treatment is gradually increasing since the clinical practice of radiotherapy has produced remarkable success and its role has become important in the cure. The following Table depicts the dominance of radiotherapy in the treatment of cancer at various sites. It is important to note that radiotherapy has important place in combination with that of surgery for improvement in cure at various sites and situations (Table 3).

**Table 3 : Frequency of Radiotherapy and Surgery**

Cancer distribution	Radiotherapy alone (%)	Surgery plus Radiotherapy (%)	Surgery alone (%)
Oral cavity	80	15	5
Pharynx	90	10	0
Larynx	68	22	10
Cervix uteri	95	0	5
Lymphoma <sup>+1</sup>	40	0	0
Breast	16	50	34
Lung	85	10	5
Bladder	38	38	24
Digestive tract <sup>++1</sup>	3	5	53
Skin	70	10	20

<sup>+1</sup> Disseminated lymphomas are treated by chemotherapy.

<sup>++1</sup> The remaining cases are either not suitable for any treatment or are considered only for palliative chemotherapy.

The main advantage of radiotherapy is that it is non-mutilating procedure and now it is frequently used as the primary treatment modality for many cancers, such as head and neck, larynx, pharynx, oesophagus, oral cavity, cervix, Hodgkin's disease, prostate, testis and skin. Approximately one in every two cancer patients benefits from radiotherapy and is cured in early stages. The development of radiotherapy planning techniques and equipments which facilitate high quality localization and computer dosimetry have given a new dimension in precision radiation treatment and have produced

new heights in cure. In recent years the advances in radiation dosimetry, physics and radiobiology have paved the foundation for more effective use of radiation therapy for improved cure in cancer. The replacement of radium by the new artificial radioactive isotopes, especially Caesium-137 and Iridium-192, with the use of afterloading techniques has contributed to an appreciable increase in local control of tumours related to oral cavity and uterine cervix.

Radiotherapy, by its total commitment to cancer problem, is the epitome of Oncology. To achieve cure, it is absolutely essential that a correct and uniform dose of radiation reach the target volume. The assessment of tumour and techniques to achieve this objective require high degree of precision.

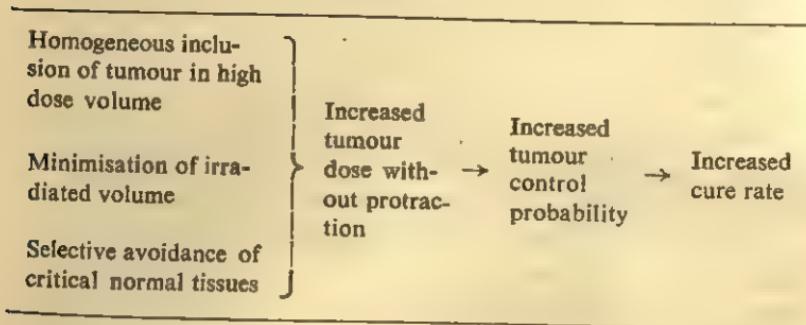
Remarkable results have been achieved during the last decade in the treatment of cancer. This is attributed mainly to the integration of multi-modality therapy—surgery, radiotherapy and chemotherapy. The overall survival rate in many forms of cancer related to head and neck, breast, oesophagus, urinary bladder and bone tumours, today is in the range of 50-60 per cent. Significant gains have been achieved in the area of cancer in children with the combination of surgery, radiotherapy and chemotherapy. The results of treatment are in the range of 40-50 per cent. This has been possible with proper surgical approach and aggressive radiotherapy and chemotherapy. In malignant lymphoma, radiation therapy has made significant gains in the cure. The disease, commonly known as Hodgkin's disease, is now curable to the extent of 90 per cent by extended radiotherapy to all involved lymph-nodes.

Also major advances have been achieved in the treatment of uterus cancer, more precisely in the cervix, with the advent of the after-loading system and radium substitutes. This has given a new direction in the radiation dose delivery to the local tumours. Radiotherapy has further extended its role in the primary treatment of early cancer breast where radical treatment is given after limited surgery for the preservation of breast. This procedure has made a remarkable difference in the psychology of patients, without compromising the results.

The most important development in radiotherapy has been made with CT scan based treatment planning where the target volume is assessed accurately and beam directed radiotherapy

is planned with precision. The rationale of CT scanning in radiotherapy has shown in Table 4 where further improvement in cure has been achieved.

**Table 4 : Rationale of CT Scanning in Radiation Therapy**



The CT based planning where the target volume and surrounding normal structures and organs are clearly visualised show a significant difference in treating the target volume for improvement in cure and minimum morbidity. In addition to treatment planning the CT scan helps in assessment and staging of the tumour which helps in initial treatment decision whether radical treatment is justified to the patient. The deep seated tumours where clinical and conventional investigations revealed limited information especially in the extent of malignant lesion to the surrounding structures, the CT Scan has made a unique revolution for assessment and accurate clinical staging.

It is important to recognise that many cancers are potentially curable. The treatment methods currently available to us can cure at least one out of two cancer patients if detected and treated in early stages. There are three basic modalities available to treat cancer: Surgery, Radiotherapy and Chemotherapy. The type of treatment modality depends upon the site, type and stage of the disease. It is essential, therefore, that in the treatment of patients with cancer a rational and inter-disciplinary team approach is most beneficial and essential. The specialists with experience in these different modalities should be available for initial consultation since the decision of primary treatment is very crucial for cure.

The use of megavoltage radiation and sealed active isotopes (radium substitutes) in the treatment of cancer should be taken as one of the foremost priorities for cancer management programme. The clinical practice of precision radiotherapy has not been given utmost importance in the past and the major stumbling blocks were the expensive equipments and scarcity of trained manpower in radiotherapy and clinical oncology. It is heartening to note that the National Cancer Control Programme has given priority for development of radiotherapy facilities in all medical colleges and major hospitals in the country so that cancer control programme made fully successful.

## CHAPTER 9

# *Environmental Development and Quality of Life*

S.S. BHATTI\*

### **Introduction**

Notwithstanding the grim topicality of the subject of this chapter, it must be said in its favour that "Development, Environment and Peace"<sup>1</sup> are issues with a perennial significance. They have a curious interrelationship among themselves, which surfaces only in times of crisis. This crisis is the ubiquitous product of modern era which is characterised by "perfection of means and confusion of goals."<sup>2</sup> Our concern for these issues stems from our painful awareness of the fact that all forms of development are attended by the spectre of overwhelming pollution of natural environment and rapid depletion of natural resources. In the process, while development creates the theatrical illusion of progress, peace in all its variations becomes a casualty. It is thus pertinent to examine these issues in some depth to understand their inter-relationships. At the outset, detailed definitions of the terms used in the chapter should be in order.

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### Definitions

The term DEVELOPMENT encompasses, in a broad sense, all forms of exploitation of everything natural, *i.e.*, flora and fauna, land, water, air and the rest. Dialectically, development is the process of self-motion from the lower (simple) to the higher (complex), revealing the internal tendencies and the essence of phenomena, and leading to the appearance of the new.

"The New and Old are two opposite forces and tendencies, whose struggle, especially in society, is the driving force of development. Everything that drives, directs development in definite historical conditions is New, while everything that hampers and prevents it is Old. In the process of development, the New and Old are in dialectical interconnections. The New grows out of the Old, is contained in it in embryo; everything positive and valuable in the Old remains in the New. The emergence of the New is always a leap, the end of all contradictions and the beginning of new ones."<sup>3</sup>

The term ENVIRONMENT denotes the sum total of spacio-formal surroundings containing varied objects, *i.e.*, persons, places and things, with inbuilt conditions that may exercise primary influence on an individual's or a group's development. In a restricted physical sense, environment is what stimulates a variety of responses in the five human senses of sight, audition, taste, smell and touch. These sensory responses would vary according as the environment is spiritual, psychological, emotional or cultural.

The term PEACE broadly means freedom from conflict, disturbance or war, as a precondition for productive and creative human activity which may lead to fulfilment and happiness.

### Hypothesis

Man—the developer—is a product of heredity, environment and circumstance. Heredity is his "genetic imperative"<sup>4</sup> which

is sown in the soil of environment. The seedling is tended by a set of external conditions called circumstances. Circumstances in turn are the product of specific time, place, manner, cause, occasion, etc. In short, they constitute the surroundings of an act or event. The need for development takes birth in man's conscious urge to ameliorate his natural condition. Food, clothing and shelter are among the most familiar terms which typify the kind of amelioration that one often has in mind. Their need, in a primordial sense, and the urgency of its fulfilment are conditioned by man's animal instincts of sex, sleep, hunger and self-assertion. Being an immanent process, man's own development is the transition from the lower (simple) to the higher (complex) stage wherein the tendency to the higher is contained in the lower in a concealed form as a "genetic imperative." The higher is but the developed lower. It is thus important to discuss the complex and constantly evolving inter-relationships among development, environment and peace.

### **Discussion**

The primitive developer in caveman was motivated to be a food-gatherer by his own instinct for hunger. The act of killing wild animals was impelled as much by his environment as by circumstance. He could accomplish it—ironically—only by disturbing both his environment and peace. The constant fear of being killed during his hunting sprees would not let him have any peace anyway. But what he ended up doing was a disturbance, if only a ripple, in the ecological balance. It is possible for modern man to see in retrospect how his ancestor as a food-grower enlarged this ripple to a tide in developing land as crop-fields. But it is not possible for him to see how he himself is ruining his own environment as a greedy developer deploying the formidable means of industry and technology. In his irrepressible desire for large-scale development, modern man is becoming a willing victim of his own insidious designs. Not only does he disturb his own peace by his heartless exploitation of natural environment but also creates conditions which preclude any for his fellow human beings as well.

Although the pace of development is regulated by the animal instincts in man, the process of development itself thrives on a destruction-construction symbiosis. The so-called scientific tools of development in the modern era are industrialisation and urbanisation. New construction is made possible by the destruction of what exists—ideas, attitudes, aspirations and ENVIRONMENT. Destruction of existing environment is now being done both in kind and degree. Thus, the placid environment which was the correlate of agrarian economy has been replaced by an oppressive environment produced by industrial economy. The greed for making a quick buck comes from modern man's consciousness of his worth given by the sense of immediacy of cash-transaction of industrial economy as against the transaction-in-kind which characterises rural economy. Yet, however dismal the whole process may seem, there is no need for escape from its spectre. For, after all, higher forms of civilisations are essentially urban civilisations which thrived, thrive and will thrive on economies more complex than those of a mere food-gatherer and a primitive food-grower. Whether one knows it or not, the creation of the man-made environment as a matrix of civilisation derives from the basic will of human beings to live and work together in an atmosphere of peace and tranquillity for the general weal of mankind. Alexander Tzonis writes :

The activities and products of architecture evolve continuously, but the task of architects has always derived from the basic will of human beings to design a non-oppressive environment. This pursuit must be seen as the driving force behind any organization of the man-made environment, either in creating it or in changing it. . . . The non-oppressive environment may be expected to be the means to overcome psychological tensions stemming from the unknown, the unexplained, the unstructured. People living within it might also anticipate freedom from physical hardship such as lack of food, the threat of animals and micro-organisms or hostile climates. Essentially, however, the man-made environment might sometimes be expected to be realm within which people are not oppressed by other people.<sup>5</sup>

**Illustration**

Chandigarh may be cited as an example to illustrate what has been stated in the foregoing paragraphs. In a broad sense, the development of Chandigarh has been guided by a garden city concept. The urban environment so created—although by destroying a large number of rural settlements—is relatively one which is conducive to peace. This is due to its large open spaces, greenery and orderly town plan as well as disciplined architecture. In other words, its developed environment, i.e., a sum total of “sun, space, verdure”<sup>6</sup> and built-form, is free from the urban blight of eyesores and auditory and olfactory unpleasantnesses. Rather, it evokes a sense of agreeable taste and touch. Freedom from such irritants, combined with a well-ordered ambience, makes for an environment conducive to peace. However, this is no longer quite true of Chandigarh’s second phase which smacks of a real estate kind of development aimed at making money rather than civilising man. The built-form is harsh, heavy and concentrated. Packing too many people closely together for achieving higher densities of population is an urban paradox. Besides, there is little else in the city environment which can act as a tranquilliser for simulating conditions of peace. The cheek-by-jowl neighbourliness, characteristic of a rural habitat, works out there because the peopled *congestion* is offset by vast expanses of agricultural land. Clean fresh air, expansive tracts of greenry and lots of sun are factors which also contribute to peace in the villages.

TV antennae, telephone wires and electrical cables aggravate the visual blight of city life. It is obvious that no development can produce an environment for peace if constant vigil over possible emergence of such urban irritants is not kept. The paradox inherent in our inability to correct this enormous wrong is more ludicrous than distressing. While there are byelaws which do not permit the placement of water-tanks on roof-tops, there is none to stop you from erecting TV antennae. Building and zoning byelaws need to be regularly reviewed and updated to remove this anomaly and to accommodate the demands of technological advancement and socio-economic change.

Development of environment as built-form, through the process of urbanisation based on industrial economy, is not a child's play. It calls for creative imagination, insight, hind-and fore-sight as well as a professional commitment of a high order. All these things are in fact the price one must pay for creating conditions conducive to peace. It must be pointed that the scope of built-form is not limited to visual or audial aesthetics. Development of environment for peace must be supported by well-planned and efficiently maintained civic amenities like water supply, sewerage, electricity, etc. The lack or mismangement of these basic urban necessities can make the citizenry irritable to a pitch where talking of peace would be a ludicrous academic suggestion.

Size and kind of environment also should be considered first and foremost in any programme of development which aims at creating conditions for peace. A town plan with too many nooks and corners, suggesting no man's land or hideouts, can be quite provocative to crime. A megalomaniacal city size creates urban anonymity which works like a camouflage for acts of crime.

### **Role of Architecture**

Urban environment as built-form is developed, among other things, with three basic components, namely, town plan, landscape and architecture. A town plan must never be a product to be found at the end of a process of selection and elimination initiated by a development approach based on "zoning". The segregation of urban activities into zones and the application of the "open plan" or "grid-iron plan", the functional use of every space, lead to, respectively, the uniformity and monotony of the cities, to the infringement of personal privacy in the residential areas and to the sterile rigidity of built fabric in general. A town plan, far from being so simplistic as that, must embody a broader vision of an environment in which peace becomes an appendage to an aesthetically enriching experience.

A more tangible component of peace is comfort which can be provided through a functional use of landscape elements like trees, shrubs, landforms and ground-covers.

The recent realisation that the quality of man-made environment has been steadily deteriorating (although improving in only a few instances) points towards a sense of helplessness in architecture—a crisis which must be understood to be result of man's inability to develop a non-oppressive environment. An insensitive use of materials, colours, textures, arrangement of the streets and the scale of buildings, etc. makes for an oppressive environment, within which, first and foremost, man oppresses man. The development of the man-made environment is inter-connected with man's development as a freedom-seeking being rather than as a being in search of rationality only.<sup>7</sup> It is now becoming evident—from the example of a well-planned city like Chandigarh—that not only did the modern movement ignore these issues but also architecture in general has not so far even considered them. Architecture, being a major component of built-form, can play a decisive role in the development of environment conducive to peace if it sheds its professional pretensions of elitism to become a socially useful art.

### **Public Awareness**

As has become customary, the purpose of observing World Environment Day on 5th June every year is "to bring to the forefront the environmental problems and issues to the enhancement of public awareness of and concern for the human environment." Laudable though such an aim is, it cannot be accomplished if the "Environment Day" is to be celebrated only as an annual ritual. Video films on various aspects of environment and its management, etc. should be prepared and shown regularly in schools, colleges, universities, community centres and other public forums. Public awareness will highlight people's responsibility towards the maintenance and management of human environment. However, such programmes must not give the professionals a sense of complacency. They also need to educate themselves through regular inter-disciplinary interaction. More than organise seminars, they should draw up action plans aimed at the environmental improvement and development of specific areas in and around their city. Improved inter and intra-professional communication along

with a dialogue between the public and the professionals, can certainly bear fruit. In fact, a more consciously sustained professional commitment to the cause of "development, environment and peace" can lead to conditions conducive to a more productive and creative human activity.

Let's awaken our faculties to the perennial significance of the theme of this paper—Development, Environment and Peace—more as a way of life than as a matter of ritual.

### References

1. *Development, Environment and Peace* was the sub-theme of seminar organised by Chandigarh Environment Society of June 5, 1986, when it celebrated the World Environment Day.
2. I have forgotten the source of this clause. But I frequently use it in my writings for the picturesque sordidness with which it highlights the essential nature of the contemporary situation.
3. M. Rosenthal and P. Yudin, *A Dictionary of Philosophy* (Progress Publishers, Moscow, 1976), p. 316.
4. This is a phase I coined in early seventies to impart a new connotation to the word "concept" as I would use it in theory and philosophy of design, in general, and architecture, in particular.
5. Alexander Tzonis, *Towards a Non-Oppressive Environment*, (Press Series on the Human Environment, Boston, Mass. 02108, 1972), p. 11.
6. This trio was coined by Le Corbusier who frequently used the term in expounding his town-planning theories.
7. Alexander Tzonis, *op. cit.*, pp. 12 and 13.

## CHAPTER 10

# *Brain and Environment*

S.N. MATHURIA\*

The human environment comprises of physical, chemical, biological and social influences and all these have effect on the well-being of the individual. Poor sanitation and communicable diseases therefrom are the greatest causes of morbidity and mortality. These environmental factors causing human health hazards can be considered under a few headings. Only the factors affecting brain and central nervous system (CNS) will be discussed.

The environment is constituted by home, work, road side, climate, altitude and organic (insects, rodents) and inorganic (air, water, food and soil etc.) matters. The effects are due to environmental pollution by chemicals (neurotoxicants), social and work interactions and home, occupational and transport accidents.

Environmental pollution by biological matters in the form of microbials and parasites give rise to infections, which may be bacterial viral, fungal and parasitic.

### **(A) Bacterial Infections**

- These are (a) pyogenic and (b) tubercular.

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(a) *Pyogenic Bacterial Infections*: may be because of air pollution, contact or droplet infection. These may give rise to formation of intracranial or spinal abscesses or meningitis.

(i) *Bacterial meningitis*: The responsible organisms are *Neisseria meningitidis* (ABCD serologic forms), *pneumococcus*, gram-negative bacilli, *staphylococcus aureus*. Violent unpredictable outbreaks of meningitis due to *Neisseria meningitidis* occur in countries situated in meningeal belt of Africa. Case fatality in some of epidemics be 'as high as 80% (50% under 15 years age.) Sporadic and endemic forms of meningococcal meningitis transmitted by nasopharyngeal route occurs in South Africa is 50,000/year. Pneumococcal is more frequent in children below 3 years, *Haemophilus influenzae* and *Escherichia coli* are the other common agents. Accurate bacterial diagnosis can be made by counter current immunoelectrophoresis. Polyvalant vaccines is the mode for preventive measures.

(ii) *Cerebral abscesses*: These occur usually in temporal lobe, secondary to suppurative otitis media, next are metastatic from pulmonary abscess or bronchiectasis. The patient usually presents as an infective illness and raised intracranial pressure. The primary disease must be treated alongwith cerebral abscess to avoid recurrence.

(iii) *Spinal abscesses*: (1) These are usually haematogenous and present as an acute infective illness and many a times as an acute transversemyelitis, hence needs immediate investigations and surgery.

(2) *Tuberculosis*: This is invariably secondary to primary tubercular focus in the body, mostly in lungs. The incidence has markedly reduced in advanced countries but is still frequent in developing countries. The pathological entities are mostly meningitis, tuberculoma and rarely tubercular abscess. These are usual in pediatric age group.

(i) *Tuberculoma*: Intracranial tuberculoma usually presents as a space occupying lesion with seizures or visual loss and their usual locations are posterior fossa in children and cerebral hemispheres in adults.

Spinal tuberculous disease is usually extradural due to bony disease but sometimes intradural and intra-nodular

granulomas are seen secondary to meningitis. These all cause myelopathy and/or myelo-radiculopathy.

(ii) *Tuberculous meningitis* : This usually presents as chronic meningeal inflammation, though sometimes may present in an acute form due to vasculitis and sudden discharge of caseous material to subarachnoid space. Arachnoiditis can cause cisternal block, outlet block, block at arachnoid villi and hydrocephalus. Spinal arachnoiditis can cause myelo-radiculopathy (paraparesis, quadriparesis) due to vasculitis and localized constricting bands.

### **(B) Fungal Infections**

These are caused by inhalation (through paranasal sinuses). The usual fungi are aspergillus, cryptococcus, coccidiomycosis, mucormycosis, and actinomyces. The pathological lesions are in the form of granulomas or abscesses presenting as tumours, coming down to sinuses.

The other presentations are chronic meningitis and hydrocephalus.

### **(C) Parasitic Infestations**

The usual ones are cysticercosis, Echinococcosis and malaria.

(a) *Cysticercosis* : The disease is caused by cysticercous cellulosae, when man becomes intermediate host. The cause is eating contaminated pork or raw vegetables. This can be basal, cortical, intra-ventricular, mixed, spinal intradural and intra-medullary.

The symptoms caused are due to conglomeration of cysts with surrounding cerebral oedema and hydrocephalus due to intraventricular or cisternal cysts. These patients present as visual loss, seizures and space occupying lesions. This can be prevented by avoiding eating contaminated street pork or half cooked pork, washing vegetables well before eating raw.

(b) *Echinococcosis* : This is caused by *Taenia echinococcus*; transmitted through dog. The lesions are unilocular solitary primary cysts usually but sometimes cysts, and multiple cysts are also seen. Multilocular cysts (*taenia alveolaris*) in the brain

is extremely rare. Spinal hydatids are usually extradural but intradural and intramedullary cysts are also seen. Treatment is surgery.

#### (D) Malaria

The convulsions seen are due either to hyperpyrexia or cerebral involvement by production of disseminated microinfarctions by malarial parasite. A diagnosis is usually made on impaired sensorium, confusion, coma, fever, extensive parasitization of red cells by plasmodium falciparum.

Other rare parasitic infestations are due to Trypanosomes—Gambiense, Rhodesiense and Cruzi.

#### (E) Viral Infections

In this group 388 viruses have been described. Extensive human epidemic of neurologic diseases (producing high mortality) are known to have been produced by them. Twenty of them can cause encephalitic disease in man.

Venezuelan equine encephalitis—non-haemorrhagic strains of Dangue virus have been incriminated.

In the environment; climatic phenomena, biologic factors like bird migration, mosquito densities etc. determine appearance and disappearance of these viruses.

(a) *Flavi-viruses* : These are transmitted by mosquitoes.

(b) *Polio-virus* : Poliomyelitis is a common cause of paralysis in young children in developing countries. Deformity in Ghana was 5.8/1000 in school age children and mean annual incidence is 23/1000.

(c) *Entero-viruses* : Coxsachic and echoviruses have been responsible for aseptic meningitis and myocarditis in children.

(d) *EV70* haemorrhagic conjunctivitis. Lumbar radiculomyelopathy have been associated with this virus in widespread epidemic in Asia and Africa.

(e) *Measles* : Its relationship to subsequent development of subacute sclerosing pan-encephalitis has been established.

(f) *Rubella* : Neonate may have psychomotor retardation, microcephaly and aseptic meningitis. Progressive rubella pan-encephalitis has been reported in post-natal period.

(g) *Rabies* : This virus is usually found in the brain cells of rabid dogs and other animals. Anti-rabies vaccine is able to prevent the disease.

#### **(F) Acquired Immunodeficiency Syndrome (AIDS)**

It is usually a fatal disease, characterized by severe and apparently irreversible deficiency in cell mediated immunity that predisposes to opportunistic infections and unusual malignancies.

It is seen amongst sexual contacts, I.V. drug users, patients receiving blood or blood product transfusions. It is caused by an infectious agents, probably a virus. The pattern of transmission is the same as hepatitis B Virus.

30% of these patients develop neurologic symptoms which include diffuse encephalopathy, focal brain lesions, cranial nerve involvement, aseptic meningitis, retinopathy and peripheral neuropathy.

#### *Neural Trauma*

One of the most important effect of environment over cerebrospinal axis is neural trauma, which may occur at home, roadside or at working place.

(a) *The Home Accidents* : These are mostly due to the falls and constitute 2/3 of accident-deaths at homes in males and 4/5 in females and bulk of fatal cases in the elderly and the young children.

(b) *Occupational Accidents* : The contributing factors to occupational accidents are—Unsatisfactory machine guards, inadequate maintenance of equipment, defective lighting, excessive noise and vibration, unsuitable floors, walls and roofs. Road traffic accidents predominate in their frequency and seriousness as also in terms of human and economic cost. More than 150,000 deaths and 600,000 injuries occur each year. In the developing world current trends in population explosion, industrialisation and urbanization are putting heavy pressures on transport networks in general and road systems in particular. Polytrauma, head injury or spinal cord injury resulting in paraplegia or quadriplegia specially in young males

constitute an emerging type of high morbidity in developing countries. Accidents rank first or second amongst causes for hospital admissions. Consequently policies aimed at preventing and minimizing their severity should be given high priority. These accidents due to high speed vehicles give rise to fatal injuries. These head injuries may be diffuse brain injuries causing severe brain swelling, intracranial haematomas and brain stem injuries. The intracranial haematomas are extradural, subdural and intracerebral, subdural hygromas and contusions. The second is the commonest of all and possess the worst prognosis. There can be secondary insult to the brain in form of hypoxia, long continued hypotension. Incidence of these accidents can be reduced by road safety and transport policy development, and behavioural research (behaviour includes observance of signs, choice of speed, and decisions on when to overtake or cross the road). As developing countries have large and growing population of youth, so safety education for them, is important.

(c) *The Road Accidents* : Construction and maintenance of roads calls for highway engineers to design and build roads that avoids ambiguous and unexpected situations.

Road use should be segregated for certain classes. In urban areas there are wide range of vehicles, (tractor, trailers, bullock carts, bicycles, autorickshaws, hand-carts, motor cycles), persons and animals, competing for limited road space. Hence segregation and low cost improvements in the form of better markings, channellization, sign junction improvements, etc. should pay high dividends in affecting behaviour of drivers.

### Safety Factors

Wide range of vehicle types are used in developing countries (at least 18 distinct types had been observed in one Indian city) : (a) The designing should meet local safety priorities, such as protection of pedestrians. The defects in the vehicles involved in accidents should be identified for future reference.

(b) Use of restraint systems. Seat belts for cubs, light trucks, etc. are useful. Overloading of vehicles, unconventional uses of vehicles should be avoided.

(c) For two wheeled vehicle-users an obvious measure for protection against injury is wearing of safety helmets, which on average reduces risk of head injury by 30% and of being killed up to 40%. Their technical development with particular reference to comfort and function is extreme climates be further continued.

(d) Standards for importing, manufacturing or marketing engines, their size should be compatible with safety requirements.

(e) National health authorities should be made aware of their role in promotion of injury protection measures.

(f) Research in road accidents, particularly setting up of multidisciplinary accident investigation though expensive but an appropriate information network should be built up to facilitate transfer of basic data and research findings from developed world to the developing countries.

(g) Avoid the use of alcohol and other drugs before driving.

(h) Avoid fast driving, crossing speed limits, too many street signs, improper lighting.

(i) Psychological testing of drivers to detect any chronic mental stress, should be a must.

Bad accident risks are: mentally defective, psychotic, extra-unintelligent, unobservant, unadoptable, disorganised, disoriented, badly disturbed, distorted, emotionally unstable, uncontrolled aggression, criminal tendencies, selfish, self-centred, blame avoidant, intolerant, antagonist, frustrated, discontented, tense, anxious, indecisive, difficulty in concentration, lacking personal insight, fatalistic, suicidal fanatacies, indulgence, drugged, drunkard, etc.

## MENTAL HEALTH

Human behaviour is a complex product of interaction amongst environmental factors. An individual is exposed to physical, chemical, nutritional, climatic factors and social; psychological and cultural phenomena which effect the process of learning and responses.

**(A) Psychosocial Factors**

- (a) Population density.
- (b) *Population Movements* : This is likely to cause more stress due to difficulty in adapting to new environment and may even cause psychosomatic problems.
- (c) *Changing Social Structure* : Changing cultures and deteriorating economy can lead to mental symptoms.
- (d) *Living Conditions* : Resettlement, urbanization contribute to a variety of mental health problems.

**(B) Physiochemical and Biological Factors**

- (a) *Psychotropic and Other Drugs* : The psychotropic drugs used over a long period interfere with important enzyme systems. These may precipitate porphyria e.g., barbiturates and alcohol may cause mental disturbances, resembling Schizophrenia.
- (b) *Nutritional Factors* : Malnutrition modifies the growth and biochemical maturation of brain and seriously affect morphological and biochemical processes of the brain's development with consequent effects on integration and behaviour, e.g., nicotine, vit. B<sub>12</sub> and Pyridoxine play a vital role in Aminoacid metabolism in brain. Thiamine deficiency produces Wernickies encephlopathy. Thyroid deficiency (in goitrous regions) can produce structural changes in brain development (Cretinism).
- (c) *Infective agents*, e.g., Viral encephalitis can cause mental disturbances. Toxoplasma infection is passed from mother to fetus and often leads to mental disturbances due to defective brain development.
- (d) *Traumatic Factors* : Traumatic brain lesions can cause mood disturbances, personality disorders, memory intellectual impairment, psychosis and dementia.
- (e) *Radiation* : CNS is most sensitive to radiation during neural development. It can adversely affect motivation, emotion, learning and perception process.

### (C) Neuro Intoxicants

These include—

- (a) Alcoholism.
- (b) Drug abuse.
- (c) Iatrogenic diseases.
- (d) Pollutants and industrial hazards.

(a) *Alcoholism* : 7% of all adults and 19% of adolescents are problem drinkers in US and related deaths exceed 200,000, per year. The devastation is direct (from intoxication, addiction and withdrawal) or indirect (from nutritional deficiency or ethanol retarded diseases, accidents, fights, crimes, etc).

(b) *Drug Abuse* : Various psychotropic drugs cause adverse effects on the brain.

(c) *Iatrogenic Diseases* : Growing number of drugs used to treat human disease and growing number of invasive procedures used for diagnosis and therapy has generated a new environment, giving rise to a new class of illness. Some of them are given below :

- (i) *Basal Ganglia Syndromes* : Reserpine, pheno-thiazimes Levodopa.
- (ii) *Leukoencephalopathy* : Vaccines, Radiation methotrexite.
- (iii) *Encephalopathy* : Penicilline, Lithium, Phenytoin Carbamazepine, pentazocin, Vincristine cimetidine.
- (iv) *Brain Tumour* : Immunosuppression, Radiotherapy.
- (v) *Meningoencephalitis* : Immunosuppression.
- (vi) *Pseudotumour Cerebri* : Corticoids, Vit. A, Nalidixic acid.
- (vii) *Stroke* : Massage of carotid sinus, oral contraceptive, amphetamines, anticoagulants, Radiation to neck.
- (viii) *Optic-nouropathy* : Penicilamine, chloroquine, INH, ethambutol, Vincristine.
- (d) *Pollutants and Industrial Hazards*—Any contaminant or combination, present in natural environment or any part thereof in excess of the maximum permissible amount,

concentration or level prescribed by the regulations is called pollutant.

Accidental exposure to a large amount of a toxic material usually causes a well defined syndrome that often involves other organs as well as nervous system.

Toxic pollutants are defined as those that cause death, disease, behavioural abnormalities, cancer, genetic mutations, physiological malfunctions.

Some toxic substances are described below :

(a) *Lead* : Total body burden of lead in man vary with in 100-400 mg range. It naturally occurs in plants and soils. Man-made sources are lead smelting, refining, brass manufacture, combustion of lead fuels, production of storage batteries, manufacture of alkyl lead and lead paints, agricultural application of lead arsenite, burning of lead painted surfaces, incineration of leaded plastic and other material. In domestic environment are lead glazed earthen ware and flaking lead paints in old houses. High lead contents are found in soils near industrial sources such as lead smelters, storage battery works, and roadside dust in the vicinity of heavy traffic. Lead is added to automobile fuel in organic form (tetraethyl or tetramethyl) as an antiknock agent. Daily averages on busy highways is very high as near the lead smelting plants. Soft, highly acid water may dissolve lead from lead pipes. Blood levels of 40  $\mu\text{gm}/100 \text{ gm}$  or more are considered excessive and indicative of undue absorption of lead. Symptoms of clinical lead poisoning in an adult do not appear till 80  $\mu\text{gm}\%$ . Direct ingestion of pigment paints, industrial emissions and ingestion of roadside dust are main sources of exposure.

The CNS defects are mental retardation, acute encephalopathy in young children followed by permanent neurological consequences. Organic lead compounds are permanently neurotoxic and cause seizures, cerebellar ataxia, hemiplegia, decerebrate rigidity, lethargy, delirium, coma. Treatment is by dimercaptopropanol (BAL) and edetate ethylene diamine tetraacetic acid (EDTA).

(b) *Mercury*: This is potentially injurious in three forms—inorganic salts, metallic mercury (mercury vapour) and organic mercurials. Ingested metal is not ordinarily harmful. Chronic poisoning by vapour sometimes occur in miners. Inorganic

mercuric salts cause CNS symptoms rarely. Organomercurials (alkyl compounds) become more toxic as their organic moiety become smaller and simpler. Methyl and Ethyl mercury fungicides are toxic. Bioethylation of metal by micro-organisms in ocean or in polluted stream and lakes introduces deadly methyl mercury into foodchain that leads eventually to humans. The man-made sources are chlorine alkali plants, paper, plastic, pulp industries, agricultural practices and burning of fossil fuels. Methyl mercury compounds are more toxic and increased levels are found in the fish present in industrial contaminated water. Symptoms are seen at concentration of 20-60  $\mu\text{gm}\%$ . Steady intake of .3 to 1 mg will result in this level in 70 kg adult. Symptoms are : parasthesiae of mouth, tongue, limbs, constricted visual fields, blindness, hearing loss, weakness, inability to concentrate, dysarthria, tremors, incoordination. In large dosages spastic weaknesses, coma and death can occur. Treatment is BAL.

(c) *Aluminium*: Aluminium dust inhalation causes encephalopathy. Causative role for Al in human disease is yet to be known .

(d) *Arsenic* : Poisoning results from occupational or environmental exposure. This is used in insecticides, weed killers and wood preservatives. The neurological involvement is in form of painful polyneuropathy. Arsenical injections may cause haemorrhagic encephalopathy. Treatment is emetics, gastric lavage, fluid electrolyte balance and BAL.

(e) *Barium* : Used in pesticides and in radiology. Can cause periodic paralysis by lowering potassium.

(f) *Bismuth* : Reversible encephalopathy with mental derangement.

(g) *Lithium* : Used in treatment of mania, causes twitching, tremor, ataxia and dysarthria.

(h) *Manganese* : Miner's poison. Behavioural changes and parkinsonism due to basal ganglia damage.

(i) *Thallium* : is absorbed from ointments for ringworm or from depilatory creams and cause optic neuritis, generalized polyneuropathy, loss of central vision and constriction of fields.

(j) *Methanol* : 2 to 8 oz is lethal. The symptoms are drunkenness, drowsiness, headache, blurred vision. Blindness is

most common and persists even after recovery from acute intoxication. Visual activity is greatly reduced, central scotoma results with constinction of fields. Treatment is gastric lavage, supportive measures, ethanol, haemodialysis.

(k) *Organic Solvents* : Organic compounds used as solvents e.g. methyl chloride, bromide, carbon disulphide, toluene, ethylene glycol; cause toxic encephalopathy and toxic neuropathy.

## CHAPTER 11

# Noise Pollution

Y.N. MEHRA\* and S. BISWAS\*\*

Noise is an unwanted sound with a random intensity, a signal that bears no information. Inevitably, each of us is exposed at one or the other time to sound that one finds annoying and unpleasant and from which there is never any protection. This all pervading noise has been regularly quoted to be the very bane of our existence.

Nature provided the majestic elephant and the lowly ass with ear flaps that would at least partially cut down the noise level to their ear. But man is not so favoured and in a constant effort to make his existence more comfortable, has inflicted severe punishment to his helpless ears. It has been rightly pointed out that civilisation itself is noise and man's progress through the ages has been accompanied by activities involving ever increasing noise intensities. The discovery of metals and the attendant noises of beating, hammering and forging, occasioned perhaps the first situations of noise pollution. With the invention of gunpowder, man exposed his ears to a second danger. The Industrial Revolution and the development of railways and the internal combustion engine heralded in the

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noise polluted environment of our century. Concentration of both man and machine in cities (Megapolis) further accentuated the damage to the ears.

The unit of measurement of sound is a decibel and normal human exposure can vary from the minimum that the ear can perceive, i.e., 0 dB to the loudest. For comfortable hearing one needs sound at a level of 55 dB and for relaxed conversation a background of 45 dB or less. Alas, such is not available in the typical urban environment, in the average Indian household or work place. Resultantly, conversation always tends to be at a higher level and we seem to be shouting at each other. The subdued conversation of the Western World does not fit into our environment.

It is well known that extremely loud noise injures the ear. Sound of 160 decibels, e.g., from the roar of an aircraft during take off at close range can cause total deafness by rupture of the ear drums or damage to the inner ear.

Few hours of exposure to sound around 90 dB can cause a temporary shift in the threshold of hearing. If such stimuli is continued for greater than 8 to 12 hours, recovery may not take place within 24 hours of cessation.

The cumulative effects over 10 to 15 years in an industrial worker thus deserves special attention. He is at a definite risk to develop Noise Induced Permanent Hearing Loss, known earlier as "Boilermaker's Deafness".

Any body who has been to the Chandigarh or Delhi Bus Terminals, knows well the sadistic pleasure that the drivers of the buses derive with their air driven horns. Cacophony and bedlam prevails and not only is the public at risk, but the driver himself damages his hearing. The cumulative effect of such a hearing loss in an individual who carries the lives of hundreds of individuals in his hands is unimaginable as a traffic hazard. There seems to be no legislation in this aspect.

Not only does an irritating amount of street generated noise permeate indoors but our average household adds heavily to this din.

A recent mode of injury amongst the young of the well-to-do family, is the high intensity amplifier and sound systems and a number of teenagers and young adults have already inflicted damage to themselves. The changes that are noted in their ears

are normally found in an unexposed individual only around the age of 50 and above. Thus we now have a generation of teenagers whose hearing has aged much earlier than their chronological age. This will have a severe repercussion in the future.

The kitchen with its modern labour saving electrical gadgets contribute to greatly domestic noise.

And for the average Indian, every social occasion is an event to be underlined with a brass band and raucous film music on the loudspeaker till late hours at night without giving a thought to the neighbourhood.

Loud noise of sudden duration at Diwali from crackers, and other noise makers can produce temporary deafness. If the exposure is repetitive as in an army personnel from firearms, permanent damage may be noted.

Noise also produces effect on the other systems of the body. One is familiar with persons getting fatigued earlier, and suffering repeated headaches. The worst is mental torture and insomnia due to noise. People who loose their sleep get edgy and irritable. The morning blasts from religious places continue to deprive us from well needed sleep and each day starts with uneasy people cursing both themselves and others.

In addition, sounds of 140 dB can produce a number of unpleasant bodily sensations, a feeling of vibration in the head, severe pain in the middle ear, loss of equilibrium and nausea. The startle reaction to loud sounds is in fact a part of the body's complex response to an emergency. The blood pressure and pulse rates jump, muscles contract and perspiration increase, the flow of saliva and gastric juices is drastically reduced and digestion ceases temporarily.

Noise within a single room is, however, easy to control. As much as 95% of the sound may be soaked up in rugs, draperies and special acoustical tiles, that absorb sound and convert it to heat. However, most of our modern apartment houses with their thin walls and hard flooring serve only to aggravate the problem—a crying baby can keep the neighbours awake all night.

To cope with such situations, western architecture has incorporated measures to reduce noise levels below the maximal

permissible. Nearer home, no such legislations exist and anti-noise measures at the domestic level are a myth.

Happily, in the office building at least, noise control measures have become effective. The credit must go to interior decorators for proper acoustical planning and the liberal use of heavy draperies, carpeting and sound absorbing tiles. Moreover, noisy mechanical typewriters and calculators are being replaced gradually by quieter electronic machines.

Noise induced deafness is entirely preventable, but totally incurable and this serious problem must be tackled on an urgent footing.

Potential hazardous areas must be identified by undertaking sound level surveys, using noise level meters. After analysis of the results, the risk to the population is identified.

Noise level specification must be entered into new designing of both machinery and transport system. Existing machinery may be operated from sound proof booths and entire plants can be moved to isolated area, if possible.

Personal protection devices such as ear plugs and muffs play a major role in protecting the individual and their use must be made compulsory in the noisy industrial environment. Planned programme on acoustical protection must be incorporated in the health care of the worker. This should include serial audiometric evaluation to identify people at risk.

There is already a healthy awareness towards the hazards of environmental pollution. We also require a radical change in our own outlook towards unwanted sound. At the domestic level, each individual must be made aware of his role in eliminating noise. At the administrative level, proper legislation and its strict enforcement can become the catalyst in the designing of less noisy yet efficient machinery and vehicles. A notable example in this regard is the introduction of quiet-wide-bodied passenger jet aircraft and the phasing out of their extremely noisy counterparts of the earlier decade.

Only our combined contribution can help to make our daily lives a more quiet and pleasant one.

## CHAPTER 12

# *Inter-Personal Environmental Perspective*

*(Doctor-Patient Relationship)*

R. KUMAR\*

## 1. INTRODUCTION

One person is environment for another. If one is cheerful, others share the feelings of joy and pleasure. If one is sullen, others too feel the stress around them. It is this inter-personal environment besides air, water, soil, food, etc. which is of paramount importance for human happiness and health. The importance of studying this environment in relation to patients and doctors is all the more, since both the participants are under a degree of stress. The doctor has to use his professional knowledge and the skill, observing a degree of discipline and ethics to improve the patient's lot, who in turn looks upon him as a man of knowledge and science and who is pictured as kind, friendly, thoughtful and warm person, committed to do everything possible for patient's welfare. In this task he may be constrained by his ability, time, communication, money, attitude of the referral hospital, hospital systems, hospital environment, etc.

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In India medical attention is claimed as a fundamental right and in turn a good deal of sympathy and humane approach is shown in most of the clinics/hospitals, unlike in advanced countries like U.S.A., where monetary considerations rule supreme. It would be desirable to keep the Doctor free from hunger, wants and extraneous stresses, if the health care delivery is to be saved from complete commercialisation.

## 2. SOCIAL AND PHYSICAL ENVIRONMENT

Man's social and physical environment determines his exposure and susceptibility to disease-conditions. His pattern of life, the work which he does, the place in which he lives, recreation which he pursues, may all increase or decrease the likelihood of his contracting a particular disease and may encourage or impede their development. Some diseases may be found among the poor others among the rich, some among women others among men, some among young others among old, some in married others among single, some among a particular occupation, some among those living in a particular locality and so on. Despite the spectacular advances in medical science, there is much that remains unknown about chronic degenerative and incurable diseases. Since the cause may be the product of the interaction of several factors, it is necessary to explore the patient's environment.

Illness is something that happens between the patient and the doctor—the first contributing the mystery of his symptoms and the second proposing an explanation. Behind the patient is the whole weight of collective representation which is, his friends and relatives have of illness, and behind the doctor are the systems which he learned in books and during training. The therapeutic dialogue is, therefore, an exchange between two elements of society rather than two individuals. So illness is not something absolute or isolated condition, it should be understood by evaluating the meaning of the situation for the participants, in terms of their perception of the benefits and drawbacks of particular courses of action.

When people seek medical care, there are two inter-related set of demands, action values and social interactions : between one, the everyday life of the patient and the other professional

therapeutic system of organised medicine, both may have conflicting interests and priorities. The patient may be more concerned with primary symptoms of pain than the underlying disease, the doctor may be more concerned about the diagnosis and treatment of illness (and its cause), than to produce an immediate comfort. This may lead to conflict. Why? Similarly a well read layman's effort at self-diagnosis and self-treatment are as much damaging to the doctor's dignity, as they are dangerous to the patients' health and welfare.

### 3. WHAT BRINGS A PATIENT TO THE DOCTOR?

It is not the disease always. It could be morbid episode of life, illness conditions, disabilities, disorders, psychological stress, symptoms, non-diseases as well as their attempted cures. Whatever may be the complaint, it indicates disturbance in smooth pattern of existence or a change in his/her external or internal environment. Hence, while diagnosing and treating diseases, it is often important to study illness behaviour *i.e.*, the way in which given symptoms may be differentially perceived, evaluated and acted (or not acted) upon by different kinds of persons. Their full understanding requires paying attention to the underlying social and psychological context, as the cause of disturbance or studying the reasons for reduced tolerance of symptoms and his capacity to cope with the stress.

It may be related to the growth and development (as at puberty or menopause) or social events, *e.g.*, marriage, getting or loosing job, first love, first child, bereavement, illness, etc. For instance a neglected child may present as a case of abdominal pain, a divorcee with indigestion, elderly widow with painful knees, etc. the real cause being disturbed inter-personal environment. Else a young mother may bring her first child suffering from cold for fear of pneumonia, the newly wed arrives with vaginal discharge or urinary infection and 40 years old worrying about his chest pain. If the value of these symptoms is wrongly assessed, a patient may be sent away with an issue dangerously unresolved or physical symptoms due to psychological stress, distressingly and expensively investigated.

After a death in the family or that of a friend, the survivors are more at risk to present to the doctor with varying com-

plaints, especially like the ones which the deceased had suffered. A woman who loses her mother early in life, may be more vulnerable to depression in her later life. Even events like marriage or birth of a child may imply some loss, reduced independence or privacy leading to depressive episodes.

The confrontation of a doctor and patient can be turned into a positive, congenial and curative relationship, with mutual support and co-operation. Patients do not always find it easy to reveal their worst anxieties or betray their real notions without encouragement and certainly not outside the framework of relationship based on mutual confidence and respect. Understanding the patients symptoms will require a peep into his work environment, his relations with the employer and the associates at work, his sexual life, his social inter-relations and his friends.

Whether the patient's basic complaint is physical or emotional, the doctor's work starts with imaginative listening so that the patient feels that his condition is being taken seriously. It should be possible to strike a happy mean between a cold impersonal attitude adopted for the sake of objectivity and an over identification with the patient, resulting in personal/emotional involvement, with an unnecessary impairment of clinical skill.

#### 4. THE PATIENT-DOCTOR RELATIONSHIP

It is the Doctor-Patient relationship that the lay and professional perspectives and priorities most intimately meet, accommodate each other and clash. Besides patients, doctors too vary widely in their responses to illness situations. However, the doctor being member of a particular professional group, his actions are defined and confined by the law ethics, time, space, inter-professional relations and organization of medical practice. Any contact between a patient and his doctor is usually a result of conscious choice on the part of the patient. Such patient-initiated contact, with the doctor may represent desire as much for emotional support as for physical diagnosis or medication. The patient's assessment of the professional's performance will be based upon his view of such things as the doctor's interest in him, the amount of information given to

him, the willingness of the doctor to show concern, to take an interest, and his commitment to the welfare of the patient.

#### **4.1 The Interaction**

The doctor-patient relationship is that of expert-layman and it is the physician's expertise which is ultimate resource in his interaction with others. This relationship varies from complete passivity on the part of the patient, to the patient's consent to accept the advice and follow it. The interaction is expected to follow the model of guidance—co-operation; the physician initiating more of the interaction than the patient. A patient is expected to do what he is told by the expert. It may extend to mutual participation where patients are able or are required to take care of themselves e.g., in diabetes. Two other models of interaction are possible (a) the patient guides and the doctor co-operates, (b) the patient is active and the doctor passive. In a fee-for-service situation it may be certainly a case that the patient guides and the doctor co-operates. What model would you choose as a doctor or as a patient?

#### **4.2 Privileged Access**

The doctor often deals with human beings in a manner, which outside the context of the patient-doctor relationship would be criminal, immoral, scandalous or ridiculous. As part of the doctor's basic task it is frequently necessary that the patient's body be exposed and touched, that it should be *mutilated* in some way or that its biochemical functioning should be interfered with. While such activities become part of the professional's take for granted perspective, it is clearly a source of conflict, tension and upset for patients, who must readjust their usual conception of appropriate behaviour in relation to their body. To see a person naked when this is not usual and to touch and manipulate their body is a privileged access. Some of the doctors' contacts such as vaginal or rectal examination, may not be permitted to any other person; even a sexual partner. The patient's usual concept of the inviolability of his body may have to be temporarily shelved when procedural,

routine for the professional, such as the insertion of a hypodermic needle or a surgical procedure are undertaken.

The doctor usually needs access to confidential information about his patient's life on which the likelihood of his doing competent medical job may depend. These various facets of exposure, touching, manipulation, mutilation and learning intimacies all go-to-make privileged access a core feature of the patient-doctor relationship.

#### 4.3 Uncertainty

The problem of uncertainty is something to be recognised in relation to patients and doctors in all illness situations. It is the doctor's job to confirm a suspected diagnosis. A patient and his family may know only that he has abdominal discomfort, has been loosing weight and lacks energy. The diagnostic procedure reveals an advanced inoperable cancer of the stomach with a hopeless outcome. Now more is known than before *i.e.*, the area of uncertainty is reduced, but the hope may be removed. Hence there may well, be reluctance to consult about some disorder or discomfort for fear of the certainty of unfavourable diagnosis which may be found. Also the risks associated with exploration may be too high in terms of time, or facilities, the risk to the patients' health by the diagnostic procedures themselves and the distress which the exploration may cause to the patient in emotional, familial and economic terms. On the other hand failure to explore may result in a failure to detect a potentially serious condition which requires early evaluation and treatment. Since many mild and self limiting conditions present themselves in a fashion similar to the early stages of some serious ones, the doctor develops strategies to handle such cases. Perhaps the most useful strategy in relation to common symptoms is the one which attempts to minimise the risks of both types of errors *i.e.* over-diagnosis and under-diagnosis.

Some surgeons, however, cut too readily, as reflected by the fact that more than half of the appendices removed are normal. Similarly doctors frequently prescribe antibiotics as a protective measure in anticipation of a possible infection which can pose a threat to the patient's condition. On the other hand, since

antibiotic drugs can be harmful, they involve a certain element of risk for the patients. Thus good medical strategy is to use antibiotics for prophylactic purposes only, when the risk of infection is high. Some take the position that the gains from antibiotics justify their use, even when the risks of infection are only moderate.

#### **4.4 The Prescription**

It is not surprising that practitioners frequently choose to treat rather than to wait, when they think that the patient expects to be treated. Prescriptions are seen as rewards at the end of nearly all consultations. Often the time honoured methods to send the patient away after consultation, e.g., sliding one's chair back, rising to one's feet, holding the door open, fail to work, only a prescription succeeds. Since a primary expectation from the doctor is that he should do everything he can for his patients, it can easily be the case in a situation of uncertainty that the doctor may be under great pressure to do something. But the doctor must weigh the risk of doing something against the risk of delaying or deciding not to do anything. The doctor may develop a vested interest in the perpetuation of this system of doing something, since he will earn after each prescription or medicines dispensed. This will reduce the chances of real patients getting due attention. Should the reward for keeping a person well, also be available?

#### **4.5 Non-Diseases and Non-Medical Problems**

A bias toward illness in situations of uncertainty has been identified, i.e., a professional's typical assumption is that it is better to impute disease than to deny it or risk overlooking or missing it. Non-disease is defined as a diagnostic label which is established after a person has been incorrectly diagnosed as ill of a particular disease or suspected of having a disease and then after subsequent examination and test is ruled not to have it. Such false positives are non-diseases. The cause may be mimickery, normal variation or a laboratory error. It would seem that having a non-disease is hardly serious and involves nothing more than a certain amount of worry and time wasted.

on one or more visits to clinic while the medical decisions rule argues that it is more serious to miss the diagnosis by carelessness, ignorance or accident than to make a false positive diagnosis. The non-diseases highlight the importance of a variety of emotional and psycho-social problems and the tendency on the part of some doctors to define them out of the sphere of medical competence as non-medical problems. But the doctor is too close to his patients and the community to shirk in this manner. It is natural that such problems be presented to the doctor, whether he sees them a part of his task or not. If not a doctor, then who else would deal with such problem?

#### **4.6 Informed Consent**

The controversy about the informed consent has been in connection with clinical research or with non-therapeutic research, such as drug trials where the benefit is not for that particular patient (or volunteers), but for patients in general at sometime in the future. In such cases the medical personnel has to seek consent of the subjects after giving an adequate information about the facts and outcome of the drug trial, etc.

### **5. MEDICAL ETHICS**

The Hippocratic oath which represents the ethical considerations prevailing in the practice of medicine has its early reference in the first century A.D. The oath was seen in those days as an ideal to be attained rather than a norm to be observed and it was not until 14th century that it was an obligatory requirement to take the oath before starting the practice of medicine. Since then several declarations have been made, while the oath reflects a high standard of morality, many of its provisions have become obsolete. Still it is an inspiring document towards the total welfare of the patients.

Till recently, the concept of medical ethics was simple one, since it did not have a deal with knotty problems like euthanasia, abortion, forensic medicine, catrogenic disease, etc. Medical ethics in the context of drug industry, public service, registration, hospital services, nursing home as a business

adventure, specialisation to promote professionalism an association of medical men to safeguard their own interests in the community, which was irrelevant in the practice of medicine in the earlier times is now a practical necessity. Indian Medical Association has drawn a code of medical ethics which is comprehensive and a model one with its core content laying down the ethical obligation to one's patients, colleagues, and society and those for issuing certificates, notification, reports etc. Various declarations made from time to time carry moral authority with them. These can be used whenever it is appropriate to refer to the ethical dimensions of human rights. Ethics is a self-imposed regulation and an exercise in nobility of the profession. But can nobility alone fulfil the various materialistic needs of the medical personnel?

## 6. PRACTISING DOCTOR

A practising doctor in India is responsible for good deal of primary medical care, notwithstanding the stiff competition offered to him by quacks of different hues. But with due planning and trust by the government and the community he can be made more responsible to cover all aspects of primary and preventive health care. This would entail treating the private doctor as a member of continuing health care team rather than as an outsider or an adversary. This would further require change in the training programme in medical education, to make it more realistic to the needs of the society through agile imagination and capacity to speak and act in vernacular.

As today, when a doctor starts practice he finds 9/10th of his patients tend to present such symptoms which he was never taught to cure. He tends to find physical cause for every symptom overlooking the emotional and psychological reasons. But a large number of patients who consult their doctors have nothing demonstrably wrong with their bodies, but still they feel unwell. Why?

### 6.1 Minor Ailments

Once the doctor and the patient is aware of the vast field of untreated minor emotional or psychiatric illness, it will be

possible to offer considerable help by listening patiently. Ventilation of problem in this way may be much more helpful than a vast armamentarium of apparently more sophisticated medical resources. When a patient of say, common cold presents to the doctor, it is necessary to ask what is the reason of his visit, rather than ridiculing the patient. May be the patient has something more to unburden, if sympathetically treated, which he needs to clarify by discussion.

### **6.2 Why a Patient Attends for Common Cold?**

A patient may have different notions about the outcome of his visit to the doctor (a) in the hope that the doctor has some magic cure for cold; (b) for getting medical certificate for getting sick leave sanctioned, which may also imply his dislike for his job, (c) fear of underlying tuberculosis or polio which may have started as a common cold; (d) to prevent complications like bronchitis, sinusitis, pneumonia, etc. and (e) low threshold due to anxiety or depression.

### **6.3 The Neurotic**

A patient with minor psychiatric problem cannot be willing to visit a psychiatrist even if referred. Also the psychiatric services will be over-burdened if patients start coming for psychiatric help in all neurotic problems. More so, a psychiatrist is not the best person to treat minor aberrations in behaviour and inner experience. Best to treat such a case is one's own doctor, who knows the person and his environment. It would be prudent that there is none in this world who does not have any neurotic trait.

It will be useful to attach psychiatric social workers as Assistants to private doctors, to reduce their work-load and to provide psychotherapy based on present situation and difficulties alone. Such a social worker can also attempt to manipulate the patient's environment after studying his social difficulties and assets, as well as his organic and emotional problems. It will take several visits for the patient, before he accepts the ailment to be of emotional origin. This arrangement will provide an effective assessment of the patient's non-medical

problems and would prove less expensive time saving, and acceptable.

#### 6.4 First Line of Defence

A family doctor is the first line of defence for a patient of minor ailment and similarly minor ailment is the bread and butter of a practitioner. So the two participants have a mutual co-existence. A patient with a wart who thinks to be cancerous needs as much reassurance as the patient with pneumonia is in need of treatment. Similarly a practitioner cannot thrive on the income from serious patients alone.

One function of a practising doctor is to refer a seriously ill patient to a hospital. But it is in the interest of the patient, to first contact their own doctor to avoid getting dangerous and expensive hospital investigating, say in a case of anxiety neurosis. Obviously, specialists are not good in the diagnosis and treatment of anxiety neurosis. The practitioner will have continued responsibility and would be able to co-ordinate the activities of various specialists. The danger of diagnosis and self-treatment, e.g., referral to specialists is specially there if two disorders co-exist, one of which may easily be missed, particularly if it is of psychiatric origin. It is no good to consult a surgeon to get the gall bladder out, where underlying depression is overlooked.

Another function of a practising doctor is to be available for emergencies or to make arrangement for attendance at odd hours. A practitioner is your personal doctor who fulfils the role of an advisor, a confident and a friend. Doctor has to maintain a degree of impersonal objectivity. Too personalized doctoring may encourage ill health, by encouraging an infantile dependency, but too impersonal doctoring may lead to lack of faith in the treatment.

Yet another function of a practitioner is to know the patient's environment, his family background, his liabilities, stress susceptibilities etc.

Further, the practising doctor has the responsibility of imparting health education by explaining various aspects of illness and dispelling misconceptions.

## 7. COMMUNICATION

Ideal relation involves a state of communication, in which the doctor and the patient can converse with mutual confidence. It demands doctor's interest, consideration, empathy friendly objectivity understanding and the patient's full faith and co-operation. If a doctor clumsily alarms his patient while explaining the treatment or the patient gets frightened, it is a failure in communication. Often the two participants fail to understand each other, either due to language difficulty, lack of vocabulary, wrong use of technical terms, etc. The doctor may fail to understand the idiom, dialect, phraseology or use of words. The patient will either take such a doctor as stupid, in-attentive or uninterested or a snob. Often the patient does not understand what the doctor wants to know and in turn the doctor gets impatient and starts shouting in a loud voice. The problem arises specially when the patient uses medical terms or jargon when he fully believes it to be correct. But a doctor who shouts, ridicules or shows indifference would forfeit patient's respect. The doctor has to keep his cool and has to extract the information as to what the patient really means.

## 8. THE HARRIED PRACTITIONER

The practitioner has to work under great stress specially due to lack of time and lopsided priorities. In India a busy practitioner does not find more than a minute per patient to listen the history, to examine, and to explain the treatment. He is forced to pour quartz into pints and thus becomes skilled in taking short-cuts, making spot diagnosis, working on intuition, etc. This trivialises the content of consultation. We see it everyday, men in early middle age complaining of cough, who are prescribed antibiotics, the modern equipment of cough medicines, because there is no time to measure peak flow rates or take the detailed histories of smoking, that would show causes and might lead to effective plan of action; young men complaining of windy abdominal pains and morning vomiting, who are prescribed cimetidine; the modern equivalent of carminative-antacid mixtures, and perhaps a request for a barium meal examination, if we are not too pressed, because,

there is no time to measure mean corpuscular volume, glutamyltransferase activity or morning blood alcohol concentration or to take the detailed drinking history, that again would show causes, impress measured effects and might again lead to an effective plan of action. As another example, elderly women complaining of transient giddiness, weaknesses and falling or fear of falling, may be prescribed centrally acting drugs for control of labyrinthine vertigo, or antihypertensive drugs if their blood pressure seems a bit high, regardless of the many other possible causes, such as arrhythmias, presently under-reported and therefore, undertreated in elderly people, or, most often, the irreversible consequences of impaired brain function, which can be helped by walking-sticks, extra bannisters, or improved lighting, all requiring relatively simple action that, however, takes up a lot more time than writing a prescription; time we have not got, so off they go, brain function further impaired by phenothiazines or methyldopa, rather more likely to fall down and break their legs, than when they entered the clinic.

The public has always demanded that the practitioners use all the skills they have before transferring responsibility to a big hospital. But how far this demand can be met?

### **8.1 How can a Practitioner do his Best?**

Ideally a practitioner should see three new patients and 12 old patients at each session and no more. He should have separate office and nursing staff with a fully structured and well maintained clinical record available for every patient, should be allowed to make full use of government hospitals especially laboratory and X-ray departments and the consultants concerned. Also he should be provided with a reasonably good library so as to enable him to undertake most of the work now being done in medical out-patient departments of big hospitals at high cost and low social efficiency. Hence provision of additional resources and restricting the work to reasonable level is necessary. The nation has to invest more to preserve the health of its citizens and the practising doctors can be given charge for the same. The practising doctor requires suitable accommodation in various areas, improved medical records,

more time for patients, more time for reading, thinking, discussion and participation in local planning to do his best.

### 8.2 Ways Ahead

After 40 years of waiting for entrepreneurial solutions to the problems of medical care by the State in primary health centres, dispensaries, etc. the time has come to consider alternatives. This entails an end to public services as a charity by the government or a private business by the doctors. The stocks of the doctor may not be measured by their personal incomes or impressive status in the State services, but may be evaluated in terms of the health preservation of the community. A concept of community practitioner service exists apparently successfully, in such familiar societies as in Italy, France, Sweden, etc. where the practitioner works independently for the community but also draws salary from the State for the preventive services rendered by him. Given goodwill and the right combination of confidence and humility, such practitioners could work very effectively as the agents of the community, to dispense health. Public investment under this head of primary health care cannot go waste.

### 8.3 Community General Practitioner

The only way to limit and eventually to cut the red-tapism is to create a local participatory democracy in the area of health. In a properly equipped and staffed primary care service, with trained practice managers aided by computers will maintain clinical records; permitting both audit of clinical activities and the updated personal summaries, we could offer better services. The points of mutual benefit and participation can be discussed at the annual meeting of the local committees at which the Patients Advisory Committee for the ensuing year can also be elected. This would provide an essential machinery for local participatory democracy as well as system for area planning.

Community General Practitioner of this kind cannot be introduced just from above, it demands a voluntary rather than a conscript army. Initially, it can be introduced as an additional

service by involving the willing practitioners, to give a pilot trial.

Many young doctors would come forward to serve as community doctors, if given salary and also allowed practice, without restraint. This will solve the problem of unemployment among doctors and others (who would assist), prevent brain drain and encourage rural development. Such doctors assured of their bread, would act as the nucleus of multidimensional uplift of the society (besides being responsible for primary health care, more so, in countryside).

## 9. THE HOSPITAL DOCTOR

In our set up hospital doctors are not allowed private practice and practising doctors have no access to the hospital records or the consultants working there. Hence the two classes of doctors work in isolation, often critical of each other, sometimes at cross purpose and in confrontation and not always entirely to the benefit of the patient or the community. While the need for the two classes to work in unison and in close co-operation for the benefit of the community is obvious the indifference and apathy by the hospitals to the demands of participation by the practising doctor is ostensibly noted. It looks that since the hospital doctor is not paid directly either by the patient or the practising doctor and hence the apathy. Looking dispassionately at the two classes of the doctors, they earn their livelihood and thrive at the community expenses; one by getting salary from the State exchequer and the other collecting the same in small bits directly from the beneficiary members of the public, when in distress. The purpose for both is just the same, i.e., to treat and prevent disease in continuation rather than in exclusion or confrontation of each other. When a patient is to be referred to a hospital, the practitioner is put in a position of a man asking a favour for his patient.

There should be an opportunity for a willing practising doctor, to assist or to ask assistance in the medical/surgical treatment of a patient, when admitted in a government hospital. In these inflationary times it will be uncommon, if not rare for a private doctor to work in a hospital, in the interest of the patient, without any material reward and many will prefer to

spend the same time for the promotion of their own practices. This would be contrary to the fears nursed by the hospital doctor that the practising doctors would bother them too often.

Similarly, a practising doctor attaches great importance to a letter which he receives from a hospital doctor after the patient is referred to the latter. In a study 96% of such letters gave clear, practical indications about the diagnosis or treatment. But how many hospital doctors care to acknowledge, let alone, reply a practitioner's referral? However, such a reply is immensely important and the lack of this response has constantly impaired co-operation, communication, and mutual regard in many fields; besides denial of useful guidance, to the patient, which is their due. The next point is what is told to the patient about his illness by the hospital doctor. It may be that the specialist in the hospital is too conservative to give any information to the patients and leave it to the practising doctor, after prescribing, or may give only a little information. In the process the patient may feel neglected and unattended. The need for hospital-practitioner liaison committee is obvious. Such a committee has to be active and would be only then, instantly useful.

### **9.1 Specialist's Report**

A report from the specialist should be sent to the practising doctor in all cases and the same may be sent off in time for it to be of any use. Only then the practitioner will feel the continuity of personal care, check his diagnosis while the case is still fresh in his memory and inform the patient accordingly. A few suggestions are as follows :

- (a) A definite answer regarding diagnosis and treatment.
- (b) If the patient has been told about his illness, etc. the nature of the same disclosed.
- (c) A timely report.
- (d) Referral back to the practitioner after doing the needful.

Unfortunately, it is common for the hospital doctors to make disparaging remarks about their practising colleagues and to

pass sweeping judgements over their clinical acumen. This is in bad taste.

### **9.2 Faults in the Referral Letters sent by the Practitioners**

Some faults pointed out by the hospital doctors are the following :

- (a) Failure to mention one's diagnosis and the treatment already given.
- (b) Illegibility.
- (c) Brevity *i.e.*, no mention about the history or findings, etc.

This means that patient is passed on, as a problem to the hospital without committing themselves or giving away the details of his impression regarding line of management already followed. This could be due to the practitioner's preference for vagueness for fear of unsavoury criticism from the hospital colleague.

### **9.3 Suggestions to the Practitioners**

A few suggestions as given by the hospital doctors are mentioned below :

- (a) Treatment given should be mentioned in the referral letter.
- (b) Such information may be mentioned which the patient is unlikely to give in the history.
- (c) Specific reason for referral.
- (d) The letter may be preferably type-written for legibility.
- (e) A copy of the letter may be posted separately, one handed over to the patient.
- (f) Open access to hospital pathological and X-ray departments should be the rule.
- (g) Hospital should get aside a time, once a week or so, when the practising doctor could meet the consultants and discuss.

Unless there is a definite need for the patient to turn up for follow up treatment in the hospital, he should be encouraged to go back to his family doctor.

## 10. HEALTH CARE DELIVERY IMPLEMENTATION

The goal of health for all by A.D. 2000 will remain a far cry, unless the inter-personal environment between the patient and the doctors (including other members of the health team) does not show a sea-change. The requirement is felt in both the components of health givers the practitioner as well as the hospitals. Among the practitioners the trend to sell medical services has started on the pattern of USA, where the system has become fully commercialised, *i.e.*, the patients are made to pay heavily for sophisticated, sometimes hazardous and often unnecessary, investigations and surgery.

In the big hospitals, the ailing persons are treated as subjects (or is it objects?) and not full fledged human beings. The person in distress have to put up with a lot of arrogance and mis-behaviour at various levels. Similarly, the communication between the private and government doctors is almost non-existent. The attitude of the hospital component of the medical team is that of contempt and indifference rather than of co-operation and amity. The attitude is based on false ego, due to lack of training in health care delivery implementation, and due to lack of awareness of the importance of inter-personal environment.

It would be necessary to set up regional academies of health care delivery on the pattern of Lal Bahadur Shastri National Academy of Administration, Mussoorie, where a crash course in behavioural sciences may be given to all health services providers. If this is done, the incidence of shouting or pushing around by the hospital staff, of the patients and their attendance will decline. It is this aspect of inter-personal environment which is lacking, due to which there is a tendency to make the doctors liable for negligence. Though the doctors are not insurers against disease or guarantors for life and cure but the patient should get a feeling of reasonable attendance.

It is suggested to associate the members of the profession, in participation, planning and development of the health care, rather than to use them merely as tools of cure.

## 11. THE NEW DOCTOR

The need is that the private doctors accept responsibility for auditing the state of the community health, monitoring and controlling environmental diseases, planning local services, auditing the effectiveness of preventive programmes, and evaluating the population control programme by medical intervention. This will require training in the skills of community medicine, reallocation of scarce resources, and co-operation with the hospital staff.

The practice of community medicine speciality without access to the community, and a primary health care system without responsibility for the community's health, is unfortunate paradox. The political forces, emphasising on prevention, without involving the private practitioner's help, serve merely by lip-service.

### 11.1 Private Practitioner and Environment Management

The private doctor can point out to the public the effect on health of social and environmental factors. If there is a high accident rate on a local road, if a large number of persons are drinking too much alcohol, or if the population at large; living in the high rise flats, are taking psychotropic medicines, then the public should be informed, so that community action can be taken.

There are three environmental health tasks which must be performed. The first is the control of disease outbreak, e.g., measles can and should be controlled by vaccination and isolation. The second is the management of communicable diseases relating to travel by screening of immigrants and adequate immunisation. The 3rd is the monitoring of health facts relating to local industry or the water supply.

## 11.2 Auditing the Effectiveness of Preventing Programmes

This involves monitoring the effectiveness of screening and immunisation programmes, and recording the prevalence of disease-risk factors. In the case of screening the completeness of follow-up is important. Assessment of disease risk factors, such as; smoking habit, diet, weight, alcohol consumption, coervical smears, breast examinations, blood pressure recording, and eye testing is much more demanding, but quite necessary.

In the present set up the private practitioner does not have the time and resources to carry out these tasks. More so, the more time spent in community health activities, the less time is available for meeting the direct needs of the patient. But the additional resources have to flow down from the State exchequer.

## 11.3 Information Requirement

This effectively means, computerisation of practice records and their linkage to health service main frame computers at the big hospitals in the region, which may in turn be linked to the central pool. The main challenge would be developing a system on which the complete data of each patient could be updated. This leads on to the need to acquire other basic tools of the trade of public health doctors :

- (a) Epidemiology, i.e., how to study the pattern of diseases in a community.
- (b) Environmental medicine, e.g., role of diet, air pollution, housing, etc.
- (c) Simple health economics involving opportunity cost and resource allocation.

## 11.4 Where to Begin?

There are four obvious places to start : information exchange, resources provision, training and research.

(a) *The Information Exchange* : The information exchange between hospitals and private practice in the patients' interest,

including that of immunisation, screening, family planning and hospital admission record is desirable.

(b) *Resource Provision* : The provision of extra resources towards employment of staff or other facilities should come from the state for the private practitioners to serve well.

(c) *Training* : The private practitioners can be given training in dispensing community medicines.

(d) *Research* : There can be limited achievement in this area. Nevertheless, the aim should be to provide local support for research in practice, either from the nearest teaching hospital or direct from the health department of the government.

The need for communication between the health care providers by the government and private practitioner is paramount. It should be possible to introduce a workable, communication system, and to identify the local environment-health tasks within a forceable future, provided there is a political will to plan and determination of the various participants involved to execute.

## **12. AMERICA PROVIDES BETTER CARE ?**

It is generally accepted that American population, as also that of other developed countries, enjoy comprehensive care and the medical attention is assured to all its citizens. It is also believed that medical care is difficult to get in India. But it is contrary to the facts. Whereas in India citizens can knock at the door of any government hospital/primary health centre/civil dispensary; anywhere in India, as a matter of right. On the other hand, the American citizen is often denied treatment even if the same is available, unless he is insured or he can afford to settle the fat bills. In India, no body is refused attendance in any government hospital even if he is very poor.

### **12.1 Health Insurance**

At any time 25 million people in the USA lack health insurance and 34 million are uninsured for sometime of the year. Virtually all elderly people are covered but 12% of the whites and 19% of the minorities, under 65 are uninsured. The poor who are least able to pay for care are less likely to have

insurance. 33% of those with income below 125% of the poverty level are covered by insurance, while 25% have no health insurance of any kind.

The extent of the direct refusal of care is staggering. It was found in 1982 that over a million families were refused care, even under grave circumstances.

## 12.2 The Prevention

While we present lack of adequate preventive measures/facilities in India, the set-up in America is no spectacular. The preventive care accounts for only 2.3% of health care spendings. The shortcomings in prevention are more serious for the poor as compared to the affluent. The poor people suffer a higher proportion of preventable deaths, including lung cancer, cirrhosis of the liver, receiving fewer 'paps' smears, breast and eye examination, routine physical examination, and much higher rates of both; nutritional deficiency and obesity. Paediatric services, particularly immunisation is far from satisfactory in USA. 40% of the USA children, aged 1 to 4 years, and 66% of inner city non-white toddlers did not receive Polio and DPT vaccine in 1982. It is a result of co-existence of excessive intervention for the well insured and neglect of uninsured poor, proliferation of technology, and indifference to prevention and the erosion of compassion and its replacement by business ethics. The modern medical care truly become lopsided.

The need is to introduce community general practitioner, to implement primary health care service as mentioned in para 8.3 above. That would be a leap forward to check employment and brain drain, promote development and encourage youth development. This will result in multidimensional uplift of society.

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## CHAPTER 13

# *Parthenium : An Environmental Allergen*

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SURRINDER KAUR\*

Parthenium hysterophorum commonly known as 'Congress grass', 'Carrot weed' or 'Chatak chandni' belongs to a family of plants like chrysanthemum (guldaudi) and sunflower. However, parthenium has neither ornamental nor any food value like the others. In fact it is a nasty weed that grows unchecked and produces both skin eczema and respiratory allergy (asthma). It is a hardy weed that flourishes and replaces other prevalent weeds. The plant grows to the height of 3 to 5 feet and has characteristic flowerheads. The flowering starts early and continues for 6 to 8 months.

Parthenium was introduced in India with grain seeds imported from USA. First noticed in Pune in early 1950s, it has since been reported from most parts of Maharashtra, Bangalore, Hyderabad, Delhi, Madhya Pradesh and Haryana. Recently, it has also been spotted in parts of Rajasthan, Kerala and Kashmir. The growth is abundant in Chandigarh and the adjoining areas of Panchkula, Chandimandir and Ropar.

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The skin allergy manifests itself as generalised eczema affecting face, eyelids and neck, and later arms, legs and the torso are also involved. The allergy is worse in summer months but occurs all through the year. Initially there is swelling and redness of the skin which may start weeping. Later thick, dark and itchy patches develop over the affected parts. Adult men like farmers, gardeners and those engaged in out door activities are most affected. Young persons of either sex, children, office and factory workers may also become sensitized.

Direct contact with the plant is probably necessary for acquiring skin allergy, subsequently however, air borne dried up plant parts and hairs perpetuate the process.

The plant is found in Argentina, Brazil and Mexico and is the major cause of weed dermatitis in Texas, Minnesota, U.S.A. The growth occurs in West Indies, but skin allergy is uncommon there.



Out of 207 patients of generalised eczema patch tested in the Skin Department at the P.G.I., Chandigarh last year, 126 (92 men, 34 women) were found to be allergic to parthenium. Seventy-three belonged to Chandigarh, 21 to Haryana, 27 to Punjab and 5 to Himachal Pradesh. Nineteen out of 21 patients from Haryana belonged to Panchkula and 20 of 27 patients from Punjab belonged to Ropar. In the present season extending March to July 1986, 79 patients were diag-

nosed as having plant dermatitis out of 144, in whom a diagnosis of contact dermatitis was made. A visit to the residential areas of the patients, showed abundant growth of parthenium in the vicinity of the houses, parks, open spaces, playgrounds, roadsides and even inside the lawns of the houses.

The treatment of parthenium dermatitis (skin allergy) is not easy. Long term administration of corticosteroids is required for the control of symptoms. Removal of the sufferer from the parthenium infested area is expected to help, but is not practicable in most cases due to family, social and economic reasons. Medical problems developing in significant section of population result in loss of working hours, personal discomfort and social handicap. However, there should not be unnecessary panic, since like other allergic substances, parthenium sensitization occurs following repeated contact in susceptible individuals only.

The plant is not relished by cattle and hence grows unchecked. The abundant growth of the plant is a cause of serious concern for all. Chemical eradication of the extensive growth is expensive. To check this menace at State and national level stringent measures like repeated uprooting and burning of the plant should be undertaken before summer months when flowering starts. The horticulture department of U.T. Chandigarh is trying to remove the growth by cutting, but within few days new plants sprout from the left over stems. Public participation is equally essential for eradication of the new environmental menace, every individual in the community and the family can help in the wider interest of the humanity.

## CHAPTER 14

# *Tilting Ecological Balance the UCI Way : A Viewpoint*

D. BANERJI\*

The programme to achieve Universal Child Immunisation in India by 1990 (UCI-90) appears to be unexceptionable. Nobody will question the desirability of providing protection to children against childhood tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, measles, and to mumps and rabies. Probably because of these sentimental considerations, some very fundamental epidemiological, administrative, ecological, economic, social and political implications of UCI-90 have got hopelessly obscured. What is even more serious, the crusading zeal of the advocates of UCI-90, backed up with a massive propaganda campaign launched by organisations like the UNICEF, the World Bank and the US Agency for International Development (USAID), now poses a real threat to one of the most cherished achievements of the peoples of the countries of the Third World.

The philosophy of Primary Health Care advocated that health service development must start from the people themselves, so that the entire edifice of the health services might be built with a mix of technology and administrative structure,

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which is tailor-made to serve the interests of the people, rather than serving the political and economic interests of exploiting classes. Community self-reliance and social control over medical technology and intersectoral action for health are the keystone of the philosophy of primary health care. The UNICEF and its powerful backers are making a massive effort to reverse this historic gain by inhibiting community self-reliance and social control over medical technology by making people once again dependent on western countries for funds, vaccines and equipments.

To begin with, if we turn to the epidemiological analysis of UCI-90 in India, we are astonished to learn that such a gigantic programme has been launched without having even the most basic data on the infectious diseases. Even the incidence rates of the diseases are not known. Then how will it be possible to determine the cost-effectiveness of the programme? Actually, there ought have been much more detailed analysis, than merely pointing out the incidence rates, as to how different are the rates in different parts of the country and what the ecological, cultural, social and other factors are which influence the rates through influencing the balance between the host, the parasite and the environment. Information should have been provided on what are the trends in the epidemiological behaviour of the different diseases over a time period, what should be the epidemiological strategy for intervention in the natural histories of the diseases and so on.

Administratively, the exponents of UCI-90 seem to indulge in collective amnesia to wish away the bitter experiences of major vertical programmes like the mass BCG campaign, the National Malaria Eradication Programme and the three efforts at eradication of small-pox which preceded the WHO-sponsored Global Eradication Programme. Also actively shunned are the many lessons from the failures of vertical programmes about trachoma, leprosy, filariasis, cholera and sexually transmitted diseases. Furthermore, it is obviously unrealistic to expect the formation of an effective nationwide network of field workers who would be able to provide epidemiologically effective immunisation coverage to over twenty-four million children that are born every year in more than 560,000 villages, towns and cities throughout the length and breadth of the country.

Even more unrealistic is the assumption that it would be possible to develop cold chains in a country where more than a half of the population lives in regions which become scorchingly hot in summer and where the logistic conditions are woefully inadequate (e.g., Rajasthan). Finally, and perhaps most importantly preoccupation of the health administrators with implementation of UCI-90 will lead to the neglect of other components of health services, including, ironically, the services for mothers and children which are supposed to be so dear to UNICEF.

There are also profound ecological implications which ought to have been taken into account before launching UCI-90. Even if it were possible to save some children by providing them protection against the diseases, these children would be condemned to live a life of virtual 'living death' under the hostile ecological conditions that prevail so extensively in different parts of the country. Many will die of causes emanating from other ecological conditions generated by the environment. Thus at a time when India was settling down to tackle the long and uphill task of applying the approach of primary health care for attaining the goal of 'health for all' in some distant future, the UCI-90 has come as a shattering blow, putting the clock back by several years.

There is thus a fundamental reversal in the relationship between the health services and the needs of the people. However, people will have a major say in the shaping of these health services. As a consequence of this approach it was recognised at Alma Ata that health services have to be visualised alongwith other services which contribute to the promotion of health of a community : there has to be intersectoral action for health. Also, health services have to be developed in an integrated form combining curative, preventive, promotive and rehabilitative services. It has also to offer coverage to the entire population. Obviously, for this purpose, it is necessary to develop people-oriented technologies. In other words, technology is to be subordinated to the needs of the people.

From a sociological point of view, the Alma Ata Declaration ought to be considered the culmination of two streams of activities. One stream consists of the programmes which have been imposed by the industrialised western countries on the

Third World countries. This imposition of technocentric health programmes on Third World countries had been a part of the wider efforts of the western industrialised countries to acquire social and economic control over them.

The recent efforts of some western powers to hit out at the very core of the philosophy of primary health care by imposing technocentric vertical programmes against a few diseases in the name of saving children, adds a qualitatively different dimension to the counter-movement. This movement not only tends to fragment a health care system and takes it away from a wider ecological, inter-sectoral and integrated approach, but it also actively hinders community self-reliance and seriously erodes the democratic rights of the people to participate in decisions which so vitally concern them. This is perhaps the most malignant fact of the present efforts to impose specialised technocentric programmes from outside using social marketing techniques to sell them.

It started almost innocuously in the form of a very poorly formulated report by Walsh and Warren of a very weekly conceptualised, and poorly implemented health service project in a ruthlessly ruled dictatorial country like Haiti. There were so many flaws in this article that one felt confident that nobody would take a second look at the conclusions that these authors drew from their report on the project. These authors contended that the comprehensive primary health care, as visualised in HFA 2000, is well beyond the reach of most of the Third World countries. They, therefore, used the data from the Haiti Project to plead for a selective approach targeted on a small number of diseases. Anybody who is familiar with the discipline of health administration would note that (a) the Haiti Project is based on data which are scientifically questionable; (b) operationally it is not implementable even in Haiti; (c) the conclusions are untenable socially, epidemiologically and ecologically; (d) it goes against principle of integration of health services; (e) it ignores the intersectoral nature of health development; (f) it is dependence producing and (g) it is antidemocratic.

Perhaps the first indication of the malignant character of the new trend became manifest when, in spite of the fact that

from the conceptual, methodological as well as inferential angles the article suffered from very serious flaws. It was published in the *New England Journal of Medicines* (1979), which is regarded as one of the most prestigious scientific journals of medicine in the world. Soon after, this article of Walsh and Warren began to be cited by such powerful and influential organisations, as the Rockefeller Foundation, the World Bank, the UNICEF and the US Government agencies (e.g., USAID). UNICEF, which was a co-sponsor of the Alma Ata conference on 'primary health care', started talking of selective primary health care in the form of GOBI—use of growth charts, oral rehydration therapy, breast feeding and immunisation, later on associating it with food supplements and family planning (GOBIFF). When female literacy was included, it became GOBIFFE. It is noteworthy that the UNICEF did not consider it necessary to test out this selective approach in the field before staking all its prestige and power behind it and imposing this approach on Third World countries. Later it launched what it euphemistically called Child Survival Development Revolution (CSDR), which encompasses GOBIFFE along with a major campaign of social marketing to make mothers realise the importance of survival of their children.

More recently, with considerable support from many powerful agencies in the world, UNICEF has launched a still more ambitious programme—the Universal Child Immunisation to all by 1990 (UCI-90). It may be noted that this powerful move to impose technocentric programmes on Third World countries has been sustained in spite of very categorical disapproval of this approach by an international meeting of public health administrators representing every region of WHO and more recently, by a meeting attended by some eminent scholars in public health from major schools of tropical medicine in Europe and elsewhere. Underlining their deep concern over the imposition of a 'selective' approach to primary health care from outside, the participants of the conference at Antwerp released a manifesto to the press to express their deep concern over the efforts to undermine HFA 2000.

This approach is in total contradiction with the fundamental principles underlying primary health care. . . . The primary health care approach is being used with success in many parts of the world. Being a continuous process, much remains to be done.

Experience has taught us that selective interventions tend to become permanent even though they are presented as "interim" responses only. In fact, they need specific structures which a country could not easily get rid of at the moment it would decide to reorientate its health policy towards comprehensive primary health care.

The existing global and national power structure ordains that the oppressed people of the world will have to pay yet another heavy instalment to their tormentors. The tormentors have once again to be proved wrong before they are forced to abandon their ill-conceived programmes. These forces should be fought resolutely. It is necessary to understand the social, political and ecological implications of this onslaught of Western countries on the masses of people in the Third World.

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## CHAPTER 15

# *Environmental Health and Education*

R.C. MAHAJAN\*

Nature conservation and environment protection are of paramount importance for primary health care of the humans. To overcome environmental crises, the Environmental education as emphasised in 1972 UN Conference on Environment held in Stockholm and subsequently at the Inter-governmental Conference on Environment education organised by the UNESCO in co-operation with NMEP held in Tbilisi (USSR) in October 1977 is necessary.

Environmental education is part of an overall Environmental Manager. It is concerned with teaching of those aspects of man's physical, mental and social well-being that depend on the environment. It embraces various aspects of biological, physical and chemical pollution of water, food, air and soil and flora and fauna. The subjects which will be covered under the environmental education include water supply, disposal of human and animal excreta, solid and liquid waste disposal, air, water and social pollution, food, noise and vector control, occupational and radiation hazards, housing, village and town

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planning, care of flora and fauna, environmental conservation and control of communicable and non-communicable diseases.

In all countries, environmental education is carried out at three main levels: individual, group and general public through mass media of communication. An indepth study of the literature reveals that the environmentalists are not attaching sufficient emphasis at the level of "school children" who are the future leaders of any country and who under the age of 15 constitute 42% of the total population in India. If environment education is imparted to this major group, it will be highly beneficial to the society for the environmental protection and conservation. Therefore, there is a need to start a comprehensive environment education programme for the school children.

The knowledge, attitude and behaviour of school children can be influenced by various factors like contact and personal experiences in the various environmental services, daily living experiences in the home, school and community environment and various home and community activities, relationship and experience.

The planning for effective environmental education must therefore, provide for "learning experience in environment at the school level or under the control of school personnel."

The incorporation of the environmental teaching in school needs to be governed by two factors.

- (a) the value and importance attributed to education for environment within the educational system.
- (b) the priority given to environmental protection and conservation amidst the other priorities emphasised by the Central/State Governments in the absence of an integrated educational programme.

Learning by doing and learning through example are two effective methods by which children learn. Every effort should therefore, be made to enable the children to absorb during their school life the need for and proper appreciation of practices, both by classroom teaching and day to day familiarity with good environmental practices. Proper attention to school

environmental sanitation is a prerequisite for instruction in environmental management.

Environmental education takes place in the home, school and at the community level. Whatever is taught and practised at the school should be reinforced at home and supported by the community. A certain amount of co-ordination between health education programmes in school and in the community is, therefore, essential. A further objective of environmental education in school should be not only to enable the individual student to maintain his/her own environment but also to share the responsibilities to protect others.

While utilising the school system, it must be remembered that in many countries there are large groups of school age children and young people also do not attend the school owing to the prevailing social conditions or the financial constraints. Plans should, therefore, be drawn up to meet the needs of this group.

Further one must remember that the environmental problem in each State or town is different. The educational content should relate to the environmental needs prevailing at the time in that geographical area and therefore, the curricula should be adopted to regional needs whatever necessary.

For the success of this programme, preparation of school teachers to handle environmental education through attention to their basic training and in service training is essential to the success of any educational efforts. Any success of school environmental education will depend upon the quality and motivation of teachers. It is, therefore, unrealistic to expect teachers to give training in habits to which they themselves are not accustomed. Thus necessary attention has to be given to them in environmental education during basic preparation and in service training of teachers for successful implementations of environmental education programme.

Since environmental education will be taught year after year, a planned programme in teaching is necessary. The curricula for each grade must be related to the changing needs and interests of children at different ages.

Chandigarh administration in collaboration with the Environment Society of Chandigarh has introduced a scheme "Catch them young" to provide environmental and health

education in all the 190 schools of the Union Territory. Saturday is observed as the school environmental/health education day. For this a circular is sent on a particular local environmental/public health problem and teachers are requested to teach the student at morning prayers time and also in the classroom. This topic is changed periodically. All the officials working in the health department like sanitary inspectors, LHV, sanitary supervisors, vaccinators and ANM are allotted one school each in their respective areas to help in the enforcement of environmental/health education in the allotted school and also to maintain the coordination. If a similar programme is implemented by the other State/UT Governments through the use of audio-visual media, it will go a long way to have a healthy environment.

Similarly the administration with the co-operation of our society has also introduced another scheme to educate the "Captive audience" in the dispensaries, health centres and hospitals on environmental and health matter through the use of video-film shows. This is useful because the humans are more receptive to learning when they are in stress. Such programmes can help in bringing a change in the outlook of individuals which will help tremendously in preservation and protection of favourable environment, prevention and control of communicable diseases and ultimately promotion of health. This scheme should also be introduced in other places in the country for the ultimate benefit for all of us.

## CHAPTER 16

# *Environmental Eye Diseases*

AMOD GUPTA\*

Of all the sensory organs, eyes are the most sensitive and complex and unlike the vital organs, have not been provided with natural protection because of the very nature of their function *i.e.*, to see and hence are ever exposed to the vagaries of environment that surrounds them. Environmental eye diseases can be grouped under two heads:

- (a) Eye diseases related to Natural elements in the environment; and
- (b) Eye diseases related to the environment in the immediate vicinity *i.e.*, the living conditions.

### 1. ENVIRONMENTAL EYE DISEASE : NATURAL ELEMENTS

Though as yet there is no conclusive evidence as to the cause and effect relationship between exposure to the natural elements and the resultant eye diseases. Environmental factors have been incriminated in the causation of several eye diseases such as pterygium, climatic keratopathy, senile cataract, early

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onset of presbyopia and the aging macular degeneration. Many of these diseases have been associated with exposure to excessive sunlight hours through the year particularly the amount of ultraviolet radiation reaching the eye. It is an established fact that trees play an important role in protecting us from the harmful ultraviolet radiations. Indiscriminate felling of trees is expected to lead to an increase in the incidence of these eye disorders. Other environmental factors like high winds, dust, low humidity hot and arid conditions also play an important role in causation of these disorders.

(a) *Pterygium and the Environmental Factors:* Pterygium is a fleshy overgrowth of conjunctiva over the cornea in the interpalpebral area and in severe cases adversely affects vision by encroaching on the pupillary zone. Various environmental factors like exposure to wind or dust, saw dust or ultraviolet radiation have been incriminated in its pathogenesis.<sup>1-3</sup> In a population survey conducted by Jain & Ram (1983)<sup>4</sup> in rural block of Naraingarh (Ambala District, Haryana), 5.6% of the population was found to be afflicted with pterygium as compared to 0.37% in urban population of Chandigarh (Jain, 1972).<sup>5</sup> This particular block lies between 30°-02'-25' and 31°-10'-35' north latitude and 76°-10'-55' and 77°-36'-20' east longitude. It remains dry and dusty from March to June, with day temperature touching a high of 116°F towards middle of June. It is believed that chronic microtrauma by dust and soil particles in field workers who at the same time are exposed to higher levels of ultraviolet radiation may lead to pterygium (Jain & Ram, 1983).<sup>5</sup>

(b) *Climatic Keratopathy:* Climatic keratopathy is characterized by elastotic degeneration of the bowman membrane of the cornea and superficial stroma with thinning of the overlying epithelium. Clinically it appears as a band shaped lesion consisting of golden coloured oil drop like deposits in superficial cornea and in advanced cases affects the vision. It is a bilateral disease and men are affected twice more often than women. Climatic keratopathy accounts for nearly 69% of all corneal degeneration seen in this part of the country (Jain, 1984).<sup>6</sup> An environmental etiology has been implicated since the condition was first described. Climatic keratopathy is believed to be four times commoner in people who spend much of their time in

outdoors than who live predominantly indoors (Garner, 1976).<sup>7</sup> It has been shown that the areas which have a higher prevalence of this degeneration have higher levels of ultraviolet radiation. Rodger (1974)<sup>8</sup> found the level of ultraviolet radiation to be 6 to 7 times greater in Dahlak island than in England. Correspondingly, the keratopathy is found in more advanced state in the people of this island and accounted for 57% of the 5.9% of the population which was blind. An inverse relationship has been found between prevalence of climatic keratopathy and the degree of shelter from sunlight provided by trees (Forsin, 1976).<sup>9</sup>

Some of the other environmental factors incriminated in the pathogenesis of climatic keratopathy are high winds and particulate injury from dust or driven snow. Hot and arid conditions or arctic areas with very low humidity have high incidence of corneal degeneration.

(c) *Effect of Environmental Factors on the Crystalline LENS:* *Early onset of Presbyopia and Senile Cataract:* Environmental factors like long wave ultraviolet radiation and high average environmental temperature have been incriminated to accelerate the aging process of the crystalline lens in the eye resulting in early onset of presbyopia and senile cataract (Miranda, 1979).<sup>10</sup> People who inhabit the tropics develop presbyopia earlier than the mid-europeans (Dische Bartela and Cremer, 1975).<sup>11</sup> In a study of 800 presbyopes by Jain *et. al.* (1982)<sup>12</sup> in the city of Chandigarh, 35.75% of the patients entered presbyopia at or before the age of 38 years and two-third of these patients lived in rural areas.

High average environmental temperature can accelerate the aging of the crystalline lens. Abdul Rehman & Cotlier (1980)<sup>13</sup> studied the effect of sunlight and ambient temperature on the lens and aqueous humor in rabbits in the city of Chandigarh. They found that sunlight raised the temperature of the lens and posterior chamber. It was postulated that this rise of temperature may accelerate cataract formation in tropical areas. Currently it is believed that long wave ultraviolet radiation may accelerate cataractogenesis by way of photo oxidation of lens proteins and liberation of free oxygen radicals which has a deleterious effect on the  $\text{Na}^+ \text{ K}^+$  ATPase pump and consequently on the lens membrane permeability. It is common

knowledge that senile cataract occurs at least a decade earlier in Indian sub-continent than in the European and other cold countries. The average temperature in Chandigarh is 84°F and touches a high of 104° to 116°F in the month of April to July. The onset of presbyopia and average temperature in various countries of the world is shown in the following Table.

Location	Average normal annual temperature in °F	Mean age of onset of Presbyopia
Norway	42	46
England	51	45.5
Australia	63	44.8
Thailand	83	40.5
Chandigarh	84	40

(d) *Aging Macular Degeneration* : Aging macular degeneration is a leading cause of economic blindness in the United States of America. Nearly 4.7% of the eye out patients above the age of 50 years suffer from aging macular degeneration (Jain *et al.* 1984).<sup>14</sup> It is believed though there is no conclusive evidence, that light induced damage to the macula may be an important contributing factor. In old people, the heat dissipating mechanism of the choroid may be compromised due to arteriosclerotic changes (Parver *et. al.*, 1980).<sup>15</sup> Another mechanism that has been proposed is that chronic photic insult may have cumulative effect over the years and lead to aging macular degeneration (TSO, 1985).<sup>16</sup> Photic insult to retina produces superoxide radicals that cause lipid peroxidation of photoreceptors outer segments membranes. These membranes are particularly susceptible because they are rich in poly unsaturated fats. Antioxidants like ascorbates, Vit. E, superoxide dimutase, glutathione, etc. act as scavengers and remove the harmful radicals. There is a possibility that relative ascorbate deficiency in old people may make them more susceptible to light damage and result in aging macular degeneration. Jain *et al.* (1984)<sup>14</sup> in fact, have reported that central cataracts have

a beneficial role in the prevention of aging macular degeneration.

### **Prevention of Environmental Diseases due to the Natural Elements**

Though there is no conclusive evidence of the cause and effect relationship. I believe there is enough evidence to this effect in the literature and it is high time that preventive measures be suggested to general public:

- (a) Use of protective glasses to avoid dust, high winds etc.
- (b) Use of sunglasses as protection against infra-red rays and blue free filters to avoid long wave ultraviolet radiation.
- (c) Use of wide brimmed hats (Mexican hats) by farmers to protect against excessive heating of eyes.
- (d) Ban on indiscriminate felling of trees and intensive drives to grow more trees and forests.

### **2. EYE DISEASES RELATED TO LIVING CONDITIONS**

Health of a society is directly related to the living conditions to which it is subjected. And health of the eyes is no exception in this regard. Crowding in the living space, open disposal of waste material, open drains, non-availability of clean water for drinking and washing, sharing of bed clothes and other clothes are some of the major factors which decide the prevalence and propagation of infective eye diseases such as the communicable ophthalmia in the society.

(a) *Communicable Ophthalmia*: (Acute and chronic conjunctivitis) In North India, corneal blindness accounts for nearly 20% of all the blind. Acute mucopurulent conjunctivitis, corneal ulceration and trachoma are the leading causes of corneal blindness which are entirely preventable.

In 1975, Jones<sup>17</sup> introduced the concept of blinding and non-blinding trachoma. Blinding trachoma lies at the core of the overlap of acute ophthalmia (Mucopurulent conjunctivitis) and chronic ophthalmia (Trachoma) which

co-exists in the society as communicable ophthalmia. This is environmentally determined by life in communities with open faecal disposal and rubbish disposal, poor personal hygiene and overcrowding in climates conducive to production of eye-seeking flies—*musca domestica* and *musca sorbens*—the latter breeding only in human excreta. Fingers, towels, bed clothes and other clothes play an important role in the transmission of communicable ophthalmia in societies where insanitation prevails.

In an ingenious experiment, Jones *et al.* (1976)<sup>18</sup> demonstrated that within 30-40 minutes, fluorescein tracing were transmitted from the eyes of one child to the tears and nasal secretions of other children in the same household *via* the fly vomits. It has been shown that in developing countries, shedding of chlymydia (Trachoma agent) in the eye secretion of moderate to severe trachoma is a major factor in the transmission of the disease by flies, fingers, etc. than in the developed countries, where the shedding of the infective agent in the eye secretions is common but the transmission rare because of absence of flies and high standards of living (Jones, 1964).<sup>19</sup>

(b) *Other Infections and Parasitic Infestations* : Over crowding and insanitary living conditions are also conducive to a high prevalence rate of communicable diseases like tuberculosis and leprosy and the eye complications resulting therefrom. Parasitic diseases like ocular toxoplasmosis and toxocaraisis result from close human contact with pets like dogs and cats. In certain regions of tropical Africa and America, onchoeciasis is a major cause of blindness next only to trachoma. It is caused by the microflaria of *Onchocerca*; man being the definitive host. The intermediate host is a fly, *Simulium*, which breeds in running water.

Prevention of blindness from infective eye diseases is a difficult task and is directly related to the upliftment of socio-economic status of the society. Improved standards of personal hygiene follow in the wake of improved literacy and standard of living. Some of the basic measures are suggested:

- (a) Emphasis on measures of personal hygiene in the school curricula.
- (b) Avoidance of overcrowded housing.

- (c) Availability of clean water for drinking and washing.
- (d) Provision of sewerage system for faecal and waste disposal.
- (e) Elimination of house flies (successfully achieved in China).
- (f) Avoidance of the use of common towels and other clothing.

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## CHAPTER 17

# *Environmental Health and Justice*

SWARAJ CHAUHAN\*

In recent years India has made significant strides in spreading public awareness about environmental protection. There is no dearth of legislation to take action against those who pollute water or air, illegally fell trees in forests and kill animals and birds without a licence. It is another matter that these laws are not enforced with vigour and earnestness.

It is in this connection that the Supreme Court's directive to the Union Government in March 1986, to examine the possibility of setting up environment courts assumes significance. Cases involving issues of environmental pollution and destruction have increased manifold in the past few years. Before we study the implications of the Supreme Court's suggestion, it is important to take notice of the fact that the past 15 years have also witnessed wanton destruction of forest wealth and indiscriminate setting up of chemical industries endangering the health and lives of both human beings and animals.

In a way the environmental health of a nation is an indicator of the quality of life led by the people. The general decline in values, as reflected in greed for personal gains and criminal insensitivity to our surroundings, have also paralysed

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agencies entrusted with the task of protecting ecological balance.

The most recent assessment about the state of our environment comes from Mr. T.N. Seshan, Secretary in the Ministry of Environment and Forests. He said in December 1986, that "we are on a suicidal path". In rural areas, he added, women had to walk even 20 km to collect firewood. "In many villages women inhale smoke equivalent to 120 cigarettes a day when they burn leaves in the absence of wood. This has happened owing to large-scale deforestation." The Forest Department in the States have been spending crores of rupees during the past 30 years and claiming that a large area has been brought under forest cover. But the Union Minister of Forests and Environment told the Lok Sabha in March 1986, that only 13 per cent of the country's geographical area is under "forest cover". The revenue records show an inflated figure of 22.7 per cent.

There is enough evidence to conclude that deforestation of watershed areas increases the severity of floods. In 1978 India suffered some of the worst floods in its history. Experts have warned that at the present rate of deforestation the dreaded Ethiopia-like drought may stalk the land in a few years from now. Every year more than Rs. 10 crore is spent on flood control measures.

Speaking at a recent seminar in Delhi, D. S. Dillon Ripley, an eminent environmentalist from Smithsonian Institute, said that in India "massive exposure of land, the soil and water and the air to the fruits of technological advance and development without regard for essential biological precepts can only hasten the degradation of what has been a fair land and a marvellous one for all manner of life". Prof. Dinesh Mohan of the Indian Institute of Technology, Delhi, says the professional bodies in India are not doing enough to maintain high standards and are not honest in dealing with problems that face the country. Giving an example, he says, "we know that Indians in areas like Punjab, Haryana and Delhi have much higher pesticide residues in their bodies than Europeans and Americans. We also have statistical evidence that people in these areas have higher rates of physical deformities than people living in other parts of the country. But we are planning to extend the same pattern of agricultural methods to U.P., Bihar. A vast majority

of scientists in India work under antiquated conduct rules which do not allow them to criticise the policies of other institutions and the Government. Nothing could be more anti-science than this attitude."

The 73rd session of the Indian Science Congress held at in January 1986, asked the Union Government to set up a national data bank on environment to facilitate a more scientific and accurate monitoring of the extent of pollution in the country. Although there are Water and Air Pollution Control Boards in different States, these have remained a mere witness even when toxic effluents have been discharged in rivers or streams and the land around. The Bhopal tragedy and the Gomti pollution at Lucknow have highlighted this aspect of the problem. Dr. T.N. Khushoo, former Secretary of the Union Department of Environment, admitted that environmental pollution control efforts in the country had failed because the ministries and public sector undertakings were "indifferent" and the "gigantic backlog" of cases was increasing.

Mr. T.N. Seshan admits that the difficulty in the execution of the environmental laws was that the alleged offenders invariably obtained stay orders from the courts. Professor Upendra Baxi, Director of Indian Law Institute, cautions that if the Government exercised its rule-making power before creating enforcement authorities, the rules are likely to be "very general guidelines". Since the decisions of the authorities will affect the citizen's legal rights, Professor Baxi adds that ways will have to be found to prevent recourse to courts and the conformitant delays and "mercurial jurisprudence of stay orders" which would defeat the purpose of the recent Environment (Protection) Act. He suggests that special environmental tribunals be created.

Last year a Division Bench of the Supreme Court made the suggestion on environment courts while allowing the Shriram Foods and Industries Limited to restart its caustic chlorine plant in Delhi. The Bench felt that environment courts could be set up on a regional basis with one professional judge and two experts drawn from the ecological sciences group in view of the nature of the case and the expertise required for adjudication.

The ecological science research group, as suggested by the Supreme Court, should consist of independent and professionally competent experts in different branches of science and technology to act as an information bank for the court and Government departments. The Division Bench presided by the then Chief Justice, Mr. P.N. Bhagwati, said that there would be right of appeal to the Supreme Court from the decision of the environment courts. The Court made a reference to the creation of the research group and environment courts after observing that it had "great difficulty" in finding out independent experts who could advise the Court on various environmental issues in the Shriram gas leak case. The dilemma faced by the Supreme Court is not much different from the one faced by lower courts while dealing with similar cases. This perhaps explains why only a handful of cases come up for adjudication in the lower courts. Even in serious cases of ecological crimes, such a massive felling of trees or setting up of industries which let out large quantities of chemical effluents into rivers or land, there is no deterrent action.

Expert help to the courts will be meaningless as long as the existing air and water pollution control legislation remains grossly inadequate in fixing responsibility. Many toxins have long term and delayed effects. There must be provision in the law for effective criminal prosecution of those responsible for running hazardous units. Under the Environment Protection Act, 1986, each new industry will have to take a clearance certificate from the Union Ministry of Environment and Forests. The penalty against the units which violate the Act includes rigorous imprisonment up to seven years, a fine of Rs. 1 lac or a daily fine of Rs. 5,000.

In India there does not exist any law that authorises the Government to even collect information on the number of chemicals imported or produced in the country. So how can the officials know about the dangers posed by these? In terms of tonnage at least 70 per cent of the pesticides used in the country have been classified as highly toxic or hazardous health by WHO.

Scientists point out that there are even more dangerous chemicals in use in India than MIC (of Bhopal notoriety). The plastic industry, for example, uses a chemical closely related

to MIC known as toluene di-isocynate (TDI) to make polyurethane foam. TDI is used more extensively than MIC and is far more dangerous to human beings. Again, a group of chemicals called polychlorinated biphenyls (PCBs) are highly toxic. These are widely used in the electronic industry and there is no control on PCB use in India. Only when these chemicals are discharged into water then the water pollution Act applies to them. There are other equally hazardous chemicals which are being manufactured, sold and used in India, and about which there is no information at all.

Out of 104 cement units in India, 84 are in private sector. Of the 20 in public sector, pollution control or treatment plants have been reportedly installed in 14 plants (whether these work or not is another matter). In the private sector units such work is in progress only in 15 industries. It is learnt that the Government is circulating draft amendments to the Water and Air Pollution Acts to the State Pollution Prevention and Control Boards. These amendments are expected to help overcome difficulties in effective implementation of this legislation and are likely to be brought for approval in the next session of Parliament in 1987. Similarly, the Factories Act, 1948, and the Insecticides Act, 1968, are proposed to be amended. A suggestion that a pollution tax can be levied on the basis of the magnitude of the pollutants discharged is worth a serious thought. The tax will have to be heavy enough to induce industries to treat effluents. Every production unit will have to file returns on emission levels at least every six months and assess tax liability. Many countries have successfully tried pollution tax. The logic is that the polluter must pay. And that too through his nose!

## CHAPTER 18

# ***Time Pollution and Health***

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S.A. SAMUEL\*

Man has been engaged in the task of exploring ways and means of solving the ever increasing problem of pollution of water and air and its effects on health. It is an accepted fact that these dangerous problems need to be tackled on a priority basis to ensure safety to the life of mankind. It is an age when the very existence of man and his safety is at stake with the problems due to increased automation, industrialisation and population explosion. Developed and developing countries are seriously engaged in seeking remedies for this menace. It is high time for us to divert our attention to a far more serious problem we are in, that is, the Pollution of Time.

The dawn of Twenty First Century is not too far. We are living in a period that is unique in the history of mankind. Two to three decades ago our generation spent their time quite differently than that of the present generation. Let us pause to consider the changes that are taking place day by day. We can see the triumph of science and technology every where and we are rightfully proud of our achievements in these areas in keeping pace with advanced countries. With better access to the world's store of knowledge, young people are able to grasp and use new ideas. The young are now staring at the flickering

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computer screens, and the young fingers are moving over the key boards. They are all struggling hard to keep pace with the newer advancements. Man has reached the moon and is now seeking a place even under the seas. Today is marked by instant culture, instant cure, instant family, instant religion and instant politics. Though these are hair raising events for the elderly, these are very common to the present day youth. They are getting way-wards in this complex and ever-changing phenomenon of life.

If we try to compare pollution of time with that of pollution of air or water, we can see that this is the worst of all. The simple reason is that impure air or water can be reused after it is subjected to purification methods. But man has not yet found a method to get back the time we have once lost. Yesterday can never come back to us. It is impossible even to have a glimpse of it. We can live in a polluted atmosphere for a short time, of course with considerable discomfort. But when the structure of time is lost or destroyed, the very basis for significance in our lives is destroyed. The pollution of time is most obvious in our loss of a sense of history, loss of cultural values and loss of recognition of our past as our own. Lack of concern for values and disrespect for those who deserve it by age and experience is routed out of this.

We can see pollution of time in the loss of myths of childhood. Children of the older generation used to be brought up by the elders in the family and the relation developed between the grand and great-grand parents for the young ones was something to be seen. Children loved their grandma's tales and grew up in their laps as secure, loved human beings. The love for one another and the trust in interpersonal relations was so strong that it bound them together for life. This was conducive to healthy mental development. As disciples of science, we no longer rear our children on fairy tales and old beliefs. We no more believe that there is a time for everything a time to be born, a time to marry, a time to get a job and a time to die. We cannot take time to observe the rites of passage. Not long ago, trousers was one such rite and only the older generation had the privilege of wearing them. But now even the toddlers have long pants. So how can a boy know that he has become a man? In case of women, ladies believed

in keeping long hairs in the past. Even in the book 'Holy Bible', we can see the mention of women in long hair as a mark of modesty. But now you can see even women over sixties, rushing to the hairdressers for a hairdo and cut short their hair. So how can a girl know that she has become a woman? These days very little attention is paid to different rituals like naming, mundan, engagement, marriage and even death. So what is left of the meaningful structure of time?

As stated by Dr. U. Ko Ko, Regional Director, WHO, South East Asia Region "The youth of today have to face tremendous problems. If age is characterised by caution, the youth is characterised by a love of risk-taking. They are facing formidable challenges in the way of unemployment and dangers of drug, tobacco or alcohol abuse. The statistics on teenage pregnancies and young motherhood, sexually transmitted diseases, suicide and accidents are also alarming. This is in addition to the new threat posed by rapidly advancing technology in some areas and the changing life styles that seem to give risk taking a fashionable dimension." These risk-taking impulses can be guided to take positive forms—sports, gardening, outdoor adventure and social experiments rather than towards the negative habits mentioned above. Studies have shown that a majority of youngsters want to help others and want to shoulder responsibilities. A good place to start may be with National Service Scheme programmes of the universities that is engaged in demonstrating healthy ways of living by advocating sanitation, nutrition, sports and so on. This can be experimented in the higher classes of our schools also.

Behind the demand for the present day youth for action and relevance and the old for law and order, is the human concern for meaning. In this search for meaning, man is essentially concerned with time, for time is the very matrix of human existence. A human being without the time concept is an utter failure. Think of one who doesn't keep up time in any walk of life—his daily routines, doing a task in time, reaching a place in time, being up to date with the advancing world or adopting fashion of the time. He is a misfit in any walk of life. He is worse than an animal—as animals too have no concept of time. But we human beings live in the memory of our past, present and the future. We take stock of past achievements or failures,

modify our behaviour in the present activity and plan for future to reach our goals.

It is time for us as elders and people with concern for the environment we live in, to plan the education in such a way to help the child to respect the natural order of time. This need to be spread in formal and informal manner for the young, old, literate, illiterate, rich, poor and for one and all. Everyone needs to learn that time cannot be treated so abstractly and casually. We must try our best to alleviate the pollution of time by quickening our awareness of time.

Recognising the seriousness of the grave problem we are in and giving it due weightage, each one needs to review one's own time polluting habits. A proper self analysis will help in identifying and eliminating such habits and inculcating a sense of time. The time through which we are passing will not judge us by our exhortations, but by our deeds. So let us individually and in groups face this challenge and win over the gigantic problem that is staring at us—that is Time-Pollution.

## CHAPTER 19

# *Environment and Integrated Health Care in India*

S.K. SHARMA\*

Development implies progressive improvements in the living condition and quality of life enjoyed by society and shared by its members. It is a continuing process that characterises all societies : none would claim that its development is complete. In all the countries irrespective of their development, people have rising expectations for improvements in total development.

'Health' in a broader sense, is essentially a decisive element for social and economic development as only when they have an acceptable level of health, can individual families and community enjoy the other benefits of life. Action to improve health and socio-economic conditions are, therefore, mutually supportive. The social factors related to the rising expectations of the people have sharpened the current needs for qualitative and quantitative improvements in health programmes. To achieve this, efficiency, economy and realism are, therefore, essential. To this end, sound use of means is facilitated by applying the concept of integration of activities, carried out

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harmoniously in a common framework, to achieve the final objective : "health for all people."

Health for all by the year 2000 A.D. is a movement to a level of health that will permit people to lead a socially and economically productive life.<sup>1</sup> This theme has fired the imagination of the people the world over. The Health planners are, therefore, busy making plans and strategies to achieve this goal.

How is this going to be done? By the use of principles of primary health care with full people's participation. These include :

- (a) Appropriate treatment for common diseases and injuries.
- (b) Maternal and child welfare services including family health.
- (c) Immunisation against major infectious diseases.
- (d) Promotion of proper food and nutrition
- (e) Development of adequate housing.
- (f) Safe water and sanitation including pest/vector control.
- (g) Prevention and control of locally epidemic diseases.
- (h) Education about prevailing health problems and ways of preventing and controlling them.

Health Services of a city basically consist of "environmental public health" and "personal" health services. While the personal health services are directed at care for the individual with the object of maintaining or restoring health and minimising the effect of illness or injury and include the preventive, curative and rehabilitative services; the environmental public health services are directed towards modification of the environment.

"Environment health" includes a geographic area and is concerned with the health of everyone who inhabits that area and is affected by environment. Environmental health treats all people alike. All breathe air, hear noise, drink milk and water, eat food and want to get rid of wastes, insects, pest vectors of diseases. If any person suffers health problem due to the degeneration of the environment, all are likely to suffer to some extent. The World Health Organisation (WHO) defines

"environmental health" as the control of all those factors in a man's physical environment which exercise or may exercise a deleterious effect on his physical development and survival.<sup>2</sup> Therefore, environmental health services include provision to citizens of safe water supply and facilities for the sanitary disposal of liquid and solid wastes, means for ensuring the hygiene quality of food and drinks, sanitary housing conditions that promote health protection against pollution of water, prevention of road accidents, control of insect-pest vectors and communicable diseases, like malaria, filaria, dengue, encephalitis, diarrhoeal diseases, infective hepatitis and non-communicable diseases.

### THE CASE FOR ACTION

The Bhore Committee (1946) appointed by the Government of India recommended the integration of preventive and curative services from Primary Health Centres at all administrative levels. Mudaliar Committee (1962) endorsed the integration of medical and health services as recommended by the Bhore Committee. Chadah Committee (1963) recommended one basic health worker for 10,000 population. These workers were envisaged as "Multipurpose workers" to look after additional duties of collection of vital statistics and family planning in addition to malaria vigilance. Mukerji Committee (1965) recommended separate staff for family planning programme and delinking the malaria vigilance activities from family planning so that the latter would receive undivided attention of its staff. Mukerji Committee (1966) recommended one Basic Health worker for 10,000 population, Health Inspector for 4 basic health workers and a Laboratory Technician. Jungalwala Committee (1967) recommended integration from the highest to the lowest level in the service of organisation and personnel. This Committee stated that "integrated approach should process of logical evolution rather than revolution. Later, Kartar Singh Committee recommended the "Multipurpose worker's scheme" to reduce the traditional stratification found at administrative and operational levels of various health programmes. This scheme involves a rational utilisation and adjustment of available technical manpower in such a manner

as to reduce the area coverage of peripheral workers and entrust each of them with the responsibility of rendering comprehensive primary health care to the rural community.

Under this scheme, the existing uni-purpose workers were trained and reoriented in the multi-purpose approach. Male uni-purpose health workers like Basic Health Workers (Malaria), Vaccinators, Family Welfare Health Workers, etc. were designated as Multipurpose Health Workers (Male). The existing Auxiliary Nurse and Midwife were designated as Health Workers (Female). Each worker works in an area consisting of a population of 5,000 to 7,000. Four such workers are supervised by a Health Assistant (Male) who is either a Sanitary Inspector, Small-pox Supervisor, Health Inspector, Malaria Inspector, etc. and four health workers (female) are supervised by a Health Assistant (female) who is either a Lady Health Visitor or Public Health Nurse. The staff appointed for insecticides spraying has not been included under the multi-purpose strategy.

A review of the rural multipurpose health worker scheme in the State/UT reveals that it has not made an impact on various activities such as communicable diseases control like malaria, filaria, diarrhoeal diseases, rabies and infective hepatitis, etc. and non-communicable diseases. The rate of accident due to bird menace has increased considerably.

In the urban areas in India personal and environmental health services are delivered separately. Even there are 3-4 organisations undertaking environmental health operations, and that too separately. This has resulted in lack of coordination, poor supervision, higher operational cost, development of resistance in insect pest vectors to insecticides, parasites to drugs, and the risk of environmental pollution is increasing day by day. There is no organised health education programme and no effort for eliciting community participation. The information and epidemiological surveillance system is in an infant stage and need to be developed further on modern lines. This calls for modification of the existing approach to urban and rural environmental public health care.

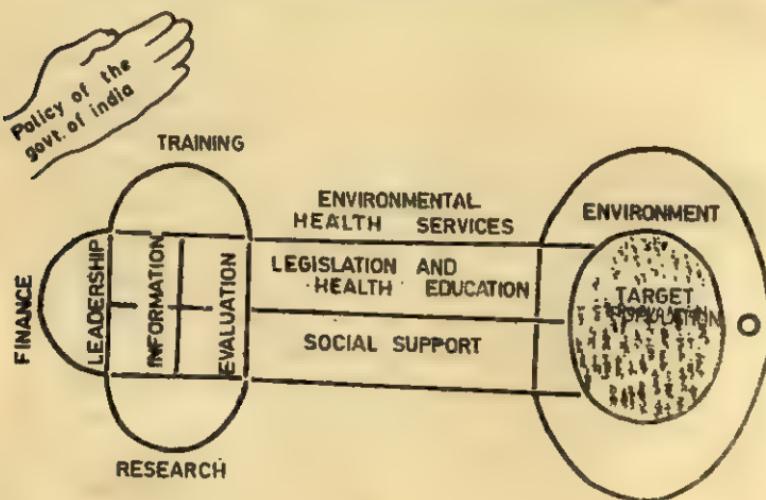
## FUNCTIONAL MATRIX OF ENVIRONMENTAL PUBLIC PROGRAMME

Health Administrators wishing to improve an existing environmental public health programme desire to know the optimal organisational structure of an environmental public health programme.

For a health administrator, an explicit appreciation of general functional framework which underlines organisational structure may help him make better plan and decisions. An attempt is, therefore, made to sketch a broad functional matrix for environmental public health programme.

Let us look at the diagram of Fig. 1 the target environment population has its own internal structure, with distinct channels of influence and communication. The task of external environmental public health programme structure is to engage the internal structure in such ways as to catalyse and mobilize forces with the population.

The environmental public health programme structure at Fig. 1 looks like a key to solve human social problems. The



**FUNCTIONAL MATRIX OF ENVIRONMENTAL  
HEALTH PROGRAMME**

FIG. 1

force behind the key is the hand of public policy. The key itself contains nine lines, each line representing a functional element. These elements fall into three groups: (a) *instrument functions* (b) *control functions* and (c) *supporting functions*. Some of the organisational aspects of each of the three major functional needs are described below :

The instrument functions are those which directly look into and activate the forces within the target population. Provision of integrated services of acceptable type with minimum convenience is of primary importance.

"Services must begin, where the people are and where the problems arise." These were the opening words of the final report of the technical discussion on health system support for primary health care held in conjunction with the Thirty-fourth World Health Assembly. The report drove home the concept that the health services of the future will not wait for the patient to come forward when illness strikes, but will instead go out to meet people, to improve people's living conditions, and to actively prevent people becoming patients.<sup>3</sup>

Therefore, community based Sanitary-cum-Epidemiological stations should be established at all the primary health centres (rural). The following organisation structure is suggested :

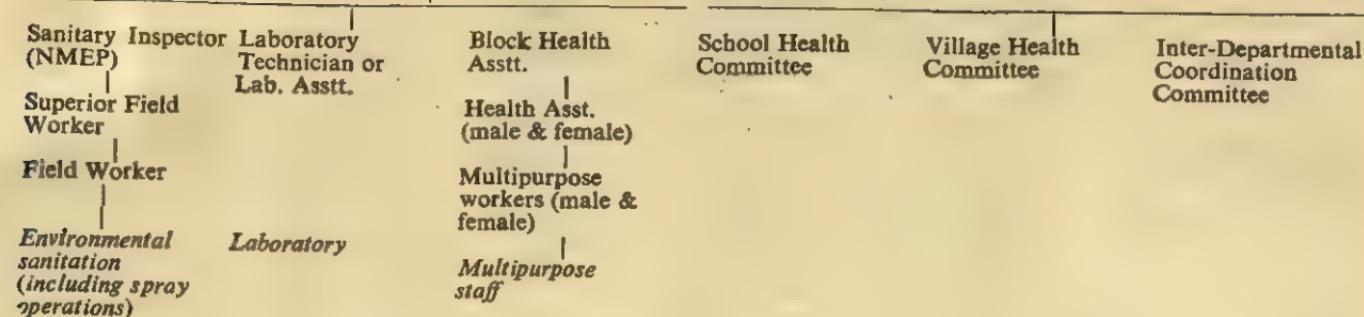
Modified human behaviour patterns could revolutionise environmental public health programmes but they are seldom achieved at a population level. They constitute the main ultimate objectives of legislation and health education activities.

Legislation and health education are interdependent. One helps the other. Legislation at community level can make useful contribution (apart from being a measure of local social discipline); for example prosecution of owners/occupiers of buildings with insanitary conditions in and around the buildings.

But all human problems cannot be tackled by regulations. Legislation is neither a permanent solution nor does it behave with the system of democracy. Surely environmental/health education tools are to be used in this direction.

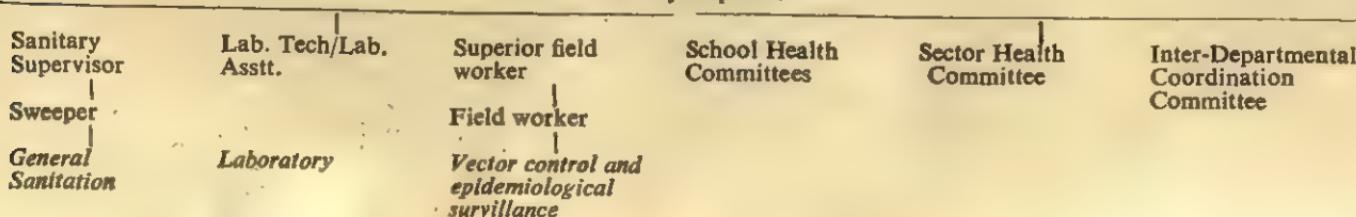
The importance of community participation in planning and implementing health programmes has long been recognised. At the Alma-Ata Conference on Primary Health Care, Com-

**Community Health Officer (P.H.C.)**

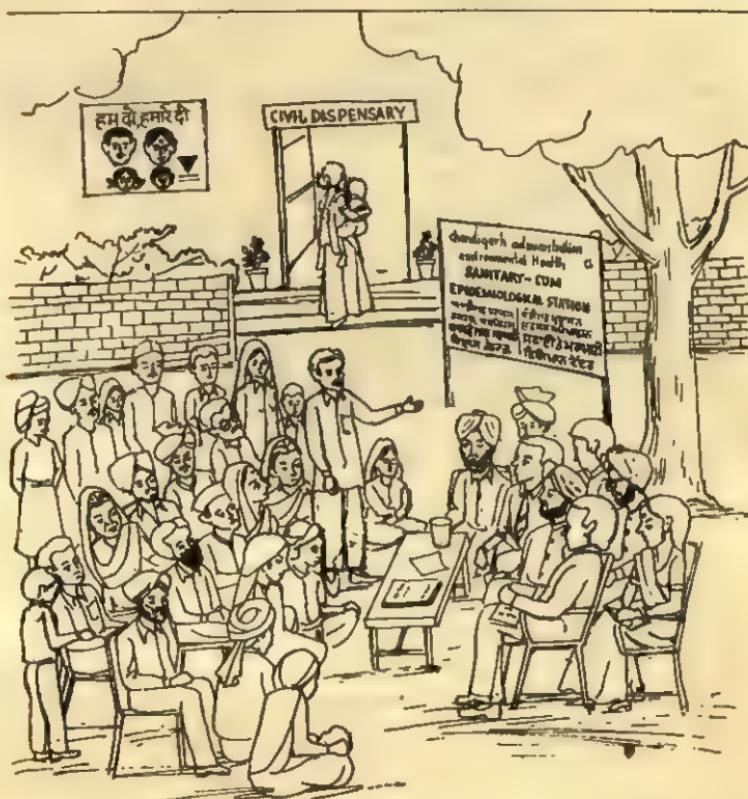


In the urban areas, community based Sanitary-cum-Epidemiological stations should be established at the Civil Dispensaries, Health Centres, Poly Clinics and Hospitals with 4 to 18 the following categories of staff;

**Sanitary Inspector**



munity participation was defined as the process by which individuals and families assume responsibility for their own health and welfare and for those of community, and develop the capacity to contribute to their welfare and community development.<sup>19</sup>



**FIG. 2. Community Participation and Inter-departmental Co-ordination at the Sanitary-cum-Epidemiological Station is Essential in Environmental Public Health Programme**

Community participation, however, does not in any way reduce the responsibility of government. On the contrary, participation of the community in their own health affairs can only take place under the leadership of health administrators. Even if the community participation does take place, it will

not last long, unless there is constant motivation and support from government or other agencies.



FIG. 3

For example, in Java (Indonesia) though the performance of community health programme was satisfactory, the project officer felt that the genuine community participation was still lacking. In summing up his feelings, he stated "this participation has no firm roots in the community and will last long as we are there to maintain it." The project officer felt that in order to launch a truly community based health care it was just to have the community participate in health efforts of health centres. Instead the community itself should be able to take over the initiative and basic responsibilities in recognising and handling its own health problems. In short, what was needed from health care for the people to the health care by the people. It was on this concept that the programme was based.<sup>20</sup>

Therefore, in order to support community participation, high power environmental health committees (also to ensure co-ordination of the various departments), operational environ-

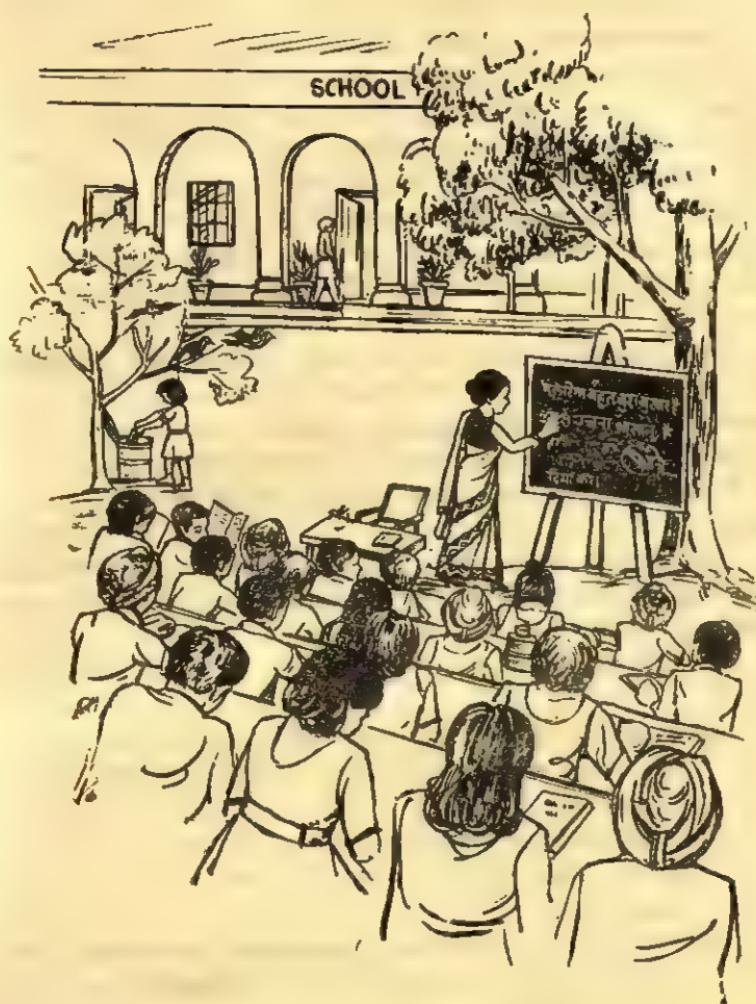


FIG. 4. Saturday should be Observed as School Environment/  
Health Education Day

mental health committees (to ensure operational bottlenecks and to report to high power committee) and sector/mohalla level environmental health committees consisting of officials of various departments, and members of the local Environment Societies, Mahila Mandals, Social Workers, etc., should be constituted.

Community participation does not reduce the commitment of the government to allocate the funds for the environmental Health Programme. Constant Financial support is needed in order to sustain continuing community participation which ensures environmental management at lowest cost and optimum utilisation of men, material and resources. But in no way should the poor be made to pay for their own health care while government continues to use national health resources for catering to the needs of only the segments of the population.<sup>21</sup>

The *control functions* serve to build, direct and coordinate the instrument functions. Top leadership and supportive supervision, is needed to give a strong direction to the programme at lower administrative levels, to elicit participation of other staff and to help identify and solve problems in implementation.

Information is the very life line of environmental public health programme. At the national/State level it is vital in the planning, management and evaluation.

The following strategies suggested :

- (a) Structural and functional integration of all types of units/cells existing at different levels into a single unit at each level.
- (b) The transmission of information needs to be strengthened so that the timely informations are sent to appropriate levels.
- (c) The use of modern data storage and processing equipment should be promoted for getting the data processed quickly.
- (d) All levels should be activised to utilize the generated data for appropriate action at their levels without waiting for feedback from the higher level; the most strategic level that needs immediate activation is the district level by establishing sanitary-cum-epidemiological stations supported by laboratory services at the primary health centres.

Well established evaluation criterion like the relationship to objective, activities and impact should be clearly taken note of

while evolving and developing the surveillance system to enable its concurrent evaluation. The evaluation activities must provide the "feedback" information that the health administrators need to monitor and improve the programme.

The supportive functions feed into and sustain the control functions. Man-power training is the most precious resource of a country. Without trained manpower, other resources cannot be properly used. This is even more true in the environmental health system than in many other systems.

In India the environmental health services are provided at a part of public health services at Central, State, district and municipal levels. The main categories of personnel involved are (a) Medical Officers with one year post-graduate diploma in public health and (b) Sanitary Inspectors who after Matriculation receive one year education in environmental health for their subsequent duties. The Sanitary Inspectors courses offered by the Health Departments in the States do not exist at a satisfactory level at all. The result is that the environmental health services are totally neglected all over the country. Besides communicable diseases, the non-communicable diseases have also grown largely in the last two decades. Food hygiene, the complex problem of chemical safety, occupational health, the long term effect of air pollution and the relationship between life styles and environmental problems are examples of the problems to be faced. Though in some States legislation did exist, there is evidence of inadequate enforcement. In spite of legislation, technology and financial resources, the problems are not dealt with properly because personnel with necessary background are not available for surveillance, monitoring and management.

As the new industries and towns develop, existing industries and towns expand, and new technology is introduced, the risk of hazards to human health increases. History has shown that industrial innovation is rarely matched in speed with corresponding protection of community and its environment.

If the concept of the professional environmental health as a field health worker is accepted, his role in public health is more easily understood and his training needs more comprehensive. He will obviously not possess the expertise of the

physician in personal health, of the veterinarian in animal health, of the microbiologist in microbiology laboratory, or of Sanitary Engineer of water supply, disposal of sewage and solid wastes. He should, however, have background and practical knowledge in those areas sufficient for him to understand the principles involved and he may develop for some specialist expertise. His wider expertise and experience will enable him to formulate an approach to make decisions for improvement of the environment, to prevent disease and promote health. Therefore, there is an urgent need to start three years degree course (B.Sc. Public Health) in public health and MPH (epidemiology) courses.

The Director, Postgraduate Medical Institute of Research and Education, Chandigarh, the Directors of Health and Family Welfare Services, Punjab and the Ministry of Health and Family Welfare, Government of India have supported this proposal.<sup>22-24</sup>

The health services research studies should be taken up immediately with emphasis on the activation of the existing machinery established at the various levels and to see the impact of the programme. If we are to achieve Health for All by the year 2000 A.D., we need to develop our integrated services supported by health education, community participation and inter-sectoral co-ordination.

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## CHAPTER 20

# *Some Suggestions for Environmental Health Protection*

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R.N. MALIK\*

Main constraints to the uninhibited growth and development are finite size of culturable land, limited mineral reserves and environmental preservation. These three constraints along-with technology and rising population form the indeterminate pentagon. Human health is the nucleus of all these activities. The common factors among these constraints are that all of them are highly interacting and with technology as base on which the entire mankind is looking for solutions. Therefore, one streak of solution is latent in deflation of these constraints. All our problems start from rising population and that too with increasing per capita energy consumption. Therefore, the solution will start from reducing our population. The crisis syndrome is of two types *i.e.*, rising aspiration and diminishing attributes and irreconcilable trade-offs, *e.g.*, choice between high yielding medicated wheat and good quality low-yield variety wheat. A few guidelines are suggested to solve the complex crisis syndrome, which is developing due to our short-sighted approach and lop sided development. How can we preserve human health, in spite of depleting resources, environmental degradation, all round pollution and population explosion?

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(a) That the present policy of growth, i.e., use of technology for aggressively exploiting the resources to meet the immediate need without caring for the finite size of land and minerals resources and environmental changes is pernicious to the humanity itself, because the growth on the present pattern and trend, can hardly sustain itself beyond 50 years.

(b) The fact that growth cannot sustain itself for long should be accepted by planners and decision makers axiomatically unless proved otherwise. All policies of development for future should blend with these constraints, e.g., finite size of culturable land, mineral resources and preservation of environment and ecological balance.

(c) The increase in total energy requirements (technological development) which in fact has created this crisis syndrome, basically stems from rise in population and increase in per capita consumption levels. Increase in population serves no purpose. There is considerable scope to work for these two objectives and efforts in these directions will yield fruitful results.

(d) There is no possibility of further major discoveries in the field of oil, coal, iron and other minerals in the mines or seabeds or even in Antarctica. Therefore, growth rates should be modified keeping in view present position of mineral resources.

(e) The possibility of harnessing of solar, wind, tidal and biomass energy to the extent of replacing conventional sources of energy, i.e., oil, coal and hydro-electricity are very, remote because of inherent limitations in these systems.

(f) Plants are great purifiers of the Environments and great ecology-balancers. Massive tree plantation on every inch of soil available should be the main-stay of future development. Tree plantation is also a surety against land erosion.

(g) The effect of pollution from fossil fuels in the space has been over-dramatised in the two reports of Club of Rome. The rains are great purifiers of stratosphere. Most of the other pollutions gets converted into water pollution and it needs to be tackled there. Ozone layer also breaks down hydrocarbons into carbon dioxide, oxygen and nitrogen. But this phenomenon does not mean that no efforts be made to abate air-pollution. The deleterious effects of air-pollution are mostly

localised. To reduce this malady, the thermal plants should be located far-away from cities and towns as in Panipat. These should be encircled by green belts. The industries causing air pollution should not be located in one sector and should be widely spaced so that exhaust gases spread over wide space area. Similarly the norms for minimum distance between two brick-kilns should be fixed.

(h) A dam should be constructed in the interior of hills. The ecological changes of the storage reservoir in the deep hilly terrains are minimum. The height and number of storage dams should be so decided that 30 to 40% of the annual run off of river goes to the sea and only 60 to 70% is stored for irrigation. Some tributaries of the main river should flow naturally. The irrigation water should be so scheduled that silt of the reservoir goes to the fields to replenish the manuring properties of soil.

(i) There should be minimum irrigation of land during the two months of the year, i.e., May and June. Heavy irrigation in these two months will create large evaporation, which will not let the formation of necessary depression in air to herald the timely arrival of monsoons.

(j) Water pollution can be greatly minimised by adopting proper management policies. There should be blanket ban on the discharge of wastes into canal, stream or river. This is a serious health hazard.

(k) We should depend more on organic manure for the crop production. The production of organic manure can result from increasing cattle population and proper recycling of domestic wastes.

(l) The construction of houses and other buildings activities should be so designed that maximum use of wood is made, e.g., by providing wooden-floors, stair-cases, etc. This is necessitated because wood is a renewable sources of energy unlike steel and other building materials.

(m) Great stress should be laid on developing hydroelectric energy as early as possible. This is cheapest source of energy besides producing minimum environmental and ecological changes. Once hydroelectric energy is developed fully, the dependence on thermal plants can be reduced and they can act as back-up source during lean-flow-periods or periods of

drought. The life span of coal mines in Singhrauli-Karba-Complex has been estimated as only 100 years by NTPC. If full hydroelectric energy is developed and the Super Thermal Plants are run only for four months of the year, the life span of coal mines can increase to 300 years and even more. The pollution of atmosphere will be reduced accordingly.

(n) Great emphasis is being laid on exploiting Nuclear Energy. Developed countries are depending greatly on development of nuclear energy. According to Dr. M.R. Srinivasan Chairman Nuclear Power Board, India, 317 nuclear power reactors in 25 countries produced in 1983 about 12% of world electricity. The share of nuclear power in the total electricity production in percentage terms is given below:

France—48.3, Belgium—45.9, Finland—41.5, Sweden—35.9, Bulgaria—32.3, Switzerland—29.3, Republic of Korea—18.4, Japan—18, W. Germany—17.8, U.K.—17, Canada—12.2, U.S.A.—12.6.

Moreover, these countries are going ahead with their nuclear power development programme and additional power reactors with a planned capacity of 194,000 MWE are under constructions. According to Dr. Srinivasan, (*Times of India* dt. 27-6-84 and 28-6-84), from pollution point of view, nuclear power plants are cheapest among non-hydro-electric sources of power and are safer than thermal plants and hydroelectric dams. But most scientists still disagree on this point and nuclear plants have so far not been cleared of their potential hazards of nuclear wastes. The issue is still hotly debated and clear-picture has not emerged out yet. Moreover the life-span of resources of raw material and global distributions is not known. Hence, it cannot be said about the nuclear energy as future dependable source of energy requirements.

(o) Use of fertilizers should be avoided in catchment areas of storage reservoir so that this water can be used for potable W/S in the plains.

(p) Population policy should be framed through legislation and should not be left on voluntary basis of people. There should be complete monitoring of births and deaths. The population control policy should work on replacement size

family, *i.e.*, two children per couple basis as in Mexico. A system of incentives and dis-incentives should be introduced. For example, a person having one daughter may be ensured a pension in the old age. Similarly, increments may be stopped if a person produces more than two or three children.

(q) Man should take himself as a creature in the lap of Nature. He should not indulge in such activities which interfere with Natural processes. Humanity has been running because, Natural agencies have not been interfered so far at any stage of evolution. Man should explore the intricate system of Nature rather than exploit it. In a bid to defeat Nature, man is simply axing on his own feet.

## CHAPTER 21

# *Environment, Sports, Physical Education and Health*

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S. BAMBAH\*

There is a direct correlation between physical education and environment. Physical education and environmental factors interact in different ways in different places. Physical education and the distribution of its benefits determine, in good measure, the state of the health, for which good environment is essential. Physical education influences the growth and development. Human resources provide the basis for development just as environmental factors constitute part of the improvement in the quality of life. If we wish to preserve the environment and improve the health status of our people, we must become aware of the essential role of physical education which can provide the knowledge and inculcate the values which will enable us to understand the environmental problems. But if sports and physical education are thus to become the driving force behind the efforts to improve the well-being of the people and to safeguard the environment, it must be reoriented in the light of this new awareness and base its approach, its content and its methods on a genuine ethos of the environment at national and international level. What must be done is to understand not

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only what is meant by physical education, but also, indeed above all, its specific functions as part of the general effort to develop and bring about a renewal in education, in order to prepare each individual squarely to take on responsibilities for safeguarding the environment.

Of course, this is not the first time the question of the role and nature of sports and physical education is being emphasized. But we have now reached the stage of exchanging information and knowledge on specific human and environmental problems, such as that of pollution, the degradation of the natural environment or the deterioration of the quality of human life. A more important task now is to drive and put into effect a type of physical education and training which will enable individuals; young and old, to assimilate the values and knowledge which will enable them to appreciate the environmental problems and thus make a useful contribution to the joint effort to improve the health status of the people. On this question of knowledge, the physical education should promote understanding of the role of the various biological and physical factors on whose interaction the very nature of environment depends. It should promote attitudes which will encourage individuals to discipline themselves in order to play a positive role in joint effort to improve the quality of health.

The Carnegie Foundation Report states : "No knowledge is more crucial than knowledge about health. No other life goal can be successfully achieved without it, therefore, students should learn about human body, how it changes over the life cycle. What motivates it and what diminishes it and how a health body contributes to emotional well being. It is a quality of life involving "dynamic interaction and interdependence among the individual's physical well-being, his mental and emotional reactions and the social complex in which he exists."

One of the important objectives of sports and physical education is to improve the individual's health through recourse to physical exercises or fitness activities. Fitness activities not only promote the individual's body but also aim at lowering risk of heart disease, blood pressure and muscle tension. Physical activities aim at cultivating "the inner athlete." George Leonard (1976) used the term ultimate athlete as

"One who joins body, mind and spirit in the dance of existence." Seeking personal well-being and harmony and oneness with the natural environment brings the inner athlete in touch with both feeling and realities. Running, the best test of all round-conditioning can provide access to beautiful surroundings and the natural environment. Orienting provides experience in knowing the natural environment. Water and winter sports bring new dimensions to the outdoor environment.

A man scaling the Rocky Face of a cliff becomes a part of the phenomenon of nature. He and the mountain are one as he makes his way to the miracle. The sportsman feels more of a person as he fights with the rushing water and cresting of a wave. He is aware of the coolness of the environment and the warmth and brightness of the sun-shine and the inner feelings of balance of motion and control. Outdoor activities combined with scientific follow-up can be a useful tool for pure ecological investigation. Motivation is seldom a problem when activities are without compulsion either from outside forces or inner neurotic drives.

It is crucial to begin with youth because incorporating physical activity into one's life-style as a matter of habit beginning early in life rather than the mere acquisition of knowledge or skill development later in life. The socialization of youth towards environmental conservation and improvement will ensure the quality of life. The awareness and benefits of the physical education to the promotion of environmental preservation should be introduced to the youngsters by education both in and out of the formal educational system and by wide use of the mass media. A great deal of stress should be laid on the role of environmental and health education in developing a sense of responsibility and solidarity at State, national and international levels.

With a view to making the necessary changes to incorporate environment and health education in the general system of education, renewal must be based on research and experiment. The use of media, especially press, television and radio needs a good of attention because of their flexibility and the wide audience they reach. Education programmes using these media are appropriate means of establishing contact with the popula-

tion. They are also means of bringing geographically isolated communities into the national community as a whole and of providing them with an education that helps them to an awareness of environmental problems.

Although Central and several State Governments in India have been using the mass media to disseminate scientific knowledge on the environment and physical education, yet a considerable effort still needs to be made in order to increase the scope, quality and relevance of environmental awareness.

Acquiring environmental education can be a part of a course. The course content can be one or many of the following list :

- (a) Ecological principles depending on time, weather and climate.
- (b) The human-body and its relation to environment. Studies in this area will relate to lung capacity, heart rate, blood pressure, many of which relate to environment, as for example, impure air is directly related to lung capacity.
- (c) Outdoor preparedness; treks with map and compass; trails; survival kit; rock climbing; geologic formation; animal habitat's understanding, etc.
- (d) Aquatic exploration; swimming; life saving boating; water analysis; sources of pollutants; etc.
- (e) Camping; Campsites; nature trails; observing animal life; forestry destruction; and survival and bird migration.
- (f) Bycycling; energy savers, flowers and fauna.

These are some suggestions for environment enthusiasts to involve youth in saving the environment through physical activities and cultivate the joy of living in a clean healthy environment.

## CHAPTER 22

# *Environmental Factors in Human Health*

P.R. RAJAGOPAL\*

### 1. INTRODUCTION

Man is both a creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. Both aspects of man's environment, natural and manmade, are essential to his well-being and to the enjoyment of basic human rights.

Humankind's attempts to attain rapid economic development and thereby to improve the standard of living and the quality of life have, on many occasions, produced vast and disruptive changes on natural resources.

It may surprise many to know that 22 centuries ago Emperor Ashoka had shown great concern not only for fellowmen but for all creation. In edicts carved on rocks and iron pillars, Ashoka defined a king's duty as not merely to protect citizens and punish wrongdoers but also to preserve animal life and forest trees. Ashoka was the first and perhaps the only monarch until very recently to forbid the killing of a large number of species of animals for sport or food.

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The factors which have a direct impact on ecology and environment are population growth, rate of economic development and technology use.

Let us take only two basic areas—food and fuel. Food production in India is targeted to go to a level of 250 million tonnes by 2000 AD. This requires large quantities of fertilizers and water. Water is becoming an increasingly scarce resource requiring conservation efforts. We just cannot afford to pollute it.

Half the energy consumed in India is for domestic use and half of that quantity is supplied by fire-wood. This, in turn, leads to denuding our forests, eroding the soil; silting the rivers, and affecting rainfall and the climate. All these emphasise the close linkages between the quality of environment, a growing world population and world economic growth needed to sustain it.

Environment is affected by four major factors—the prevailing natural condition, human population, the levels of production and consumption and also the scale and intensity of technology. The degradation of environment arising from the abject poverty manifests itself in squalor, disease, illiteracy, impure and widespread non-availability of drinking water, sanitation, malnutrition, inadequate housing, etc.

A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well-being depend.

Let us look at the environment around us. The air we breathe and the water we drink are highly polluted. Tanneries, oil refineries, thermal and nuclear power plants and effluents from myriads of factories big and small continue to deposit tonnes of toxic gases, dust and waste on our environment, endangering our lives.

## 2. WATER POLLUTION

The Ganga, symbol of purity and worshipped by the Hindus as mother which has served man faithfully for ages, fed him, watered his fields and washed his sins is today a carrier of

death and disease. Thousands of tonnes of industrial and other wastes are being emptied into it every day.

It now poses a major health hazard for the people living along its banks. Several steps taken by the Government to clean it up have proved almost ineffective.

Laboratory tests of Ganga water by scientists have proved that the water is not even fit for even bathing.

The main source of pollution at Varanasi, according to central Ganga authority, is urban liquid waste, waste from burning ghats and cattle bathing in the river.

In Varanasi there is no sewage treatment plant. Eight big and sixty-one small drains continue non-stop to pour the city's sewage into the river. Waste water flows through drains into the Ganga. In Varanasi, unwanted babies and dead people who cannot be cremated or those who are too poor to have proper cremation are simply dumped into the Ganga.

About ten thousand dead bodies are thrown in the Ganga every day. Various schemes, recently launched by the government to purify the Ganga have not made much headway so far.

Hence the Ganga purification project is an important step towards cleaning the holy river of its filth.

### 3. RISING AIR POLLUTION

According to the central board of pollution control, only 357 of the 1700 main polluting industries in the country have incorporated technology to minimise pollution.

Only 7 per cent of the industries in Bombay have equipment to control air pollution while the rest do not have any equipment either to control air pollution or to monitor the emission of pollutants into the atmosphere.

The situation is no better in respect of air pollution caused by thermal power plants. Out of the 48 plants 32 do not have electrostatic precipitators to trap fly ash which the chimney belch out relentlessly. Of the 17 precipitators only six are working satisfactorily. In Delhi, the average particulate emission from Indraprastha is about 750 microgram per cubic metre. At Badarpur, it is worst. Air quality around Badarpur power station is found to have an average of 1,200 microgram

per cubic metre, nearly 12 times the limit for residential areas and twice the limit for industrial areas.

The level of sulphur dioxide is almost thrice the permissible level of residential areas.

Phenomenal growth of automobiles is another main cause of deteriorating air quality, emitting carbon monoxide, hydrocarbons, oxides of nitrogen particulars and other pollutants like lead and benzo A pyrene.

Delhi has the highest number of vehicles, nearly 10 lakh. Vehicles in Delhi daily emit about 175 tonnes of carbon monoxide, 240 tonnes of particulates, 70 tonnes of hydrocarbon and eight tonnes of oxide of nitrogen. A study by the World Health Organisation ranks Delhi as the third grubbiest city in the world where bad air is becoming worse.

Only 38% of two wheelers and 53% of three wheelers meet the pollution limit in Delhi. In areas like Connaught Place, the air is laden with very high levels of toxic carbon monoxide, three times the permitted level. The smoke emission limit is violated by 55% of city buses, 64% inter-State buses.

Ninety per cent of mini buses and trucks have been found to exceed this limit. Most of the DTC buses have been found to have smoke intensity of 90 units against the permissible limit of 65.

A WHO sponsored study has shown that the incidence of respiratory diseases is higher in traffic dense areas. Even in low dosage, carbon monoxide may affect children's central nervous systems. Children playing near the heavily travelled highway suffer from a degree of hypoxia and consequent brain damage.

Lead, a potential pollutant is also emitted from automobiles, which is added to petrol as an antiknock agent. The lead content in Bombay has reached alarming proportions, primarily due to automobiles. The lead pollution in Calcutta with the maximum of 17 microgram per cubic metre is much higher than the maximum observed in New York with 7.5 microgram per cubic metre and London 4.8 microgram per cubic metre.

Whereas most of the developed countries have banned the addition of lead to petrol and some countries are trying to phase it out, on the contrary, India has allowed increase in octane content of petrol which means adding more lead.

The level of particulate matter with an average of 418 microgram per cubic metre and exceeding 900 microgram in winter far exceeds the prescribed limit, causing bronchial disease and asthma. A comprehensive study in Bombay has shown the health implication of air pollution. People living in the polluted areas suffer from a much higher incidence of bronchitis, TB, skin disease, breathlessness and ailments.

In Chembur area, the incidence of cough is 26%, bronchitis 8%, chest pain 12% and breathlessness 8%. An even more dismal situation prevails in smaller towns. In a town like Kota in Rajasthan the air is filled with sulphur dioxide, chlorine particles and coal dust causing a number of diseases.

### **Carbide Plant Disaster at Bhopal**

On the night of December 2-3, 1984, the most tragic industrial disaster in history occurred in the city of Bhopal. Located there was a chemical plant owned and operated by Union Carbide India [Limited. The plant situated in the northern sector of the city, had numerous hutments adjacent to it on its southern side which were occupied by the impoverished squatters. UCIL manufactured the pesticides Sevin and Temik at the Bhopal plant. Methyl isocyanate (MIC) a highly toxic gas, is an ingredient in the production of both Sevin and Temik. On the night of the tragedy MIC leaked from the plant in substantial quantities for reasons not yet determined.

The prevailing winds blew the deadly gas into the overpopulated hutments adjacent to the plant and into the most densely occupied parts of the city. The results were horrendous. Estimates of deaths directly attributable to the leak range as high as 2,100. Over 2,00,000 people suffered injuries—some serious and permanent—some mild and temporary. Livestock were killed and crops damaged. Businesses were interrupted.

### **4. NUCLEAR POLLUTION**

#### **Chernobyl Accident**

It was history's worst nuclear power plant accident. A nuclear power plant exploded. The core began to melt. A

conflagration ignited that spread a cloud of radioactivity over large parts of the world. In this case, a large part of the Soviet Union and much of eastern and western Europe were affected.

The European Governments warned people in the countryside not to drink rainwater. Children were told not to drink milk and farmers instructed to keep their cows indoors. Italy, Sweden, Austria and West Germany took steps to curb fresh food imports from the Soviet bloc countries. On May 7, the European Economic Community banned fresh food imports from the USSR, Poland, Czechoslovakia, Hungary, Romania and Bulgaria—countries within the 624 mile radius of the Chernobyl power plant.

### **MAPP Accident**

The alertness of the Madras Atomic Power plant authorities averted a major mishap when seven tonnes of heavy water escaped into a vault inside the reactor building recently. The authorities were quick in declaring plant emergency as a precautionary measure. A new transformer was being commissioned to replace the main transformer of MAPP-I which suffered a failure earlier.

While commissioning activities were in progress with the other operator reactor at 10% power level, the reactor was automatically shut down on sensing high pressure in the main heavy water coolant system. During this incident, about seven tonnes of heavy water escaped from the reactor coolant system. This heavy water has been collected and will be put back into the system after appropriate processing. Luckily this incident did not involve any release radioactivity to the environment.

If the world learns the right lessons from Chernobyl, it can achieve a major breakthrough in international nuclear cooperation in all its aspects, particularly safety.

Three Mile Island accident in 1979 in USA still haunts the world. It has all but destroyed the confidence of USA's nuclear industry.

Sweden, with 10 nuclear reactors, is already committed to closing its nuclear plants by 2010. Concrete action is needed to ensure that nuclear power is made available without any danger of environmental pollution.

## 5. EFFLUENT PROBLEM IN TANNERIES

The leather industry has registered an impressive annual growth rate of exports of about 8%. It provides employment to about 12 lakhs people most of whom belong to the weakest among the weaker sections of society.

This industry has gained notoriety by its adverse effects on ecology and environment.

The tanning industry discharges nearly 30-40 litres of waste per 5 kg of raw material processed. The inherent nature of the tanning process leads to discharge of waste water with several adverse including foul smell and putrescible matter and toxic material. The intensity of pollutational character of the effluent can be seen from the fact that biochemical oxygen demand (BOD) concentration in the vegetable tanning effluent is in the range of 6000-12000 mg/l (Milligrams per litre) which is about 30 times the strength of community sewage. In case chromium tanning process is utilised, the concentration of chromium in the effluent is at a staggering level of around 300 mg/l as against the permissible limit of 2 mg/l. The deleterious effects caused by both organic and inorganic contents of tannery effluents on environmental resources like surface water, groundwater, agricultural land and aquatic life are extremely grave.

As a result of the untreated effluents from the tanneries in the North Arcot district of Tamil Nadu, being discharged on agricultural lands, nearly 14,000 hectares of fertile land have been rendered infertile. Secondly, the drinking water supply wells in and around the tannery towns have been greatly affected. Ironically the wells in and around the tannery are not fit even for being used for process water. Further, the municipal water works at Ampur town, downstream of Vaniyambadi, built at a cost of about Rs. 45 lakhs hardly 10 years ago, had to be closed down as a result of the tannery effluents percolating into subterranean water which served as a source for the water works. The story is all too familiar the country over and one has only to substitute Ganges for river Palar and the emerging scenario is complete.

It has been estimated that the entire leather industry is discharging everyday about 60 million litres of effluent without any treatment and that if only they are treated and recycled

it would help to irrigate at least 2500 hectares of cultivated land, recharge the groundwater and also upgrade the environmental standards and protection.

## 6. POLLUTION FROM PESTICIDES

While one country after another is becoming aware of the hazards involved in the use of pesticides, India continues to manufacture or import agro-chemicals with proven harmful effects on the eco-system and human health. Nearly 70 per cent of all pesticides consumed in India belong to the category of the agro-chemicals banned or restricted in a number of countries and identified by the World Health Organisation as excessively toxic or hazardous. Yet DDT and methyl parathion, for instance, are freely available in India and consumption is increasing, despite the high toxicity of both these agro-chemicals.

Recent reports have highlighted the adverse effects of DDT sprayed vegetables, grains and fodder or human beings and animals. Intensive use of pesticides has also intended to result in "pesticides treadmill" where in the development of resistance among pests to chemicals sets in. It is necessary to introduce effective regulation of the use of chemical pesticides with a view to eventually ban the use of those identified by WHO as harmful.

## 7. MINING AND ENVIRONMENT

Mining leaves ugly scares on the earth's surface. It destroys vegetation, spoils fertility of soil, degrades human and animal habitat, creates vibrations and noise, raises dust and fumes, pollutes water, effects river courses and creates occupational health hazards.

There are scores of distressing examples of the above such as Jharia coal field, Dehradun limestone areas and Goa iron mine, to name a few, where indiscriminate mining has resulted in grave environmental ravage. In the Jharia coal field alone which cover a total area of 455 sq. km, surface subsidence consequent to underground mining has taken a toll of over 32 sq. m seriously affecting railway tracks, roads and riverbeds.

Underground, about 34 million tonnes of coal of scarce coking variety has been lost and 46 million tonnes blocked on account of 110 fires of which about 70 are still active.

A lot of environmental ravage has already been caused by mining all over the country.

It is imperative that in order to ensure the continued and sustained progress of mining industry in India, the environmental dimensions should be integrated into the planning, design, development and operation, and working practices of mining on scientific and rational lines, by the government and industry in a mutually reinforcing manner.

Introduction of the environmental element (to ensure) at the conceptual stage of a mining project, incorporation of environmental science in educational syllabii, creation of general awareness, formation of practical code, taking up afforestation, soil conservation and land reclamation programmes, water, dust, smoke and air surveys, measuring noise and vibration levels, introduction of monitoring of the progress of remedial aspects, creation of effective information system, etc., merely indicate a part of the overall environmental management. This is extremely vital in view of the fact that the major mining locations in India are in the areas of rich forests such as Western and Eastern ghats, peninsular India, Chota Nagpur region, Bastar area, etc.

Mining centres are also tribal habitat. A review of all current mining activities from the environmental angle is a must. A system of periodic environmental audit also needs to be introduced. Mining has an extremely vital role to play in nation building. This might require reservation of certain areas for mining. Mining cannot be at the expence of environment, just as environment protection could not be at the cost of mining. Both are complementary to each other.

## 8. GOVERNMENT POLICIES

Industry has to shoulder a major responsibility to ensure that the environment will not expose us to the risk of disease and disaster. Yet the machinery of the State will have to accept an equally onerous responsibility to ensure that the industrial policy, especially in its locational aspects, will be so properly

planned that indiscriminate growth of colonies and settlements especially near the potentially hazardous industries is kept under check.

Industries were allowed to be set up at various sites which already had thickly populated villages on the clear understanding and assurance that in due course of time the villages would be relocated. Many of these understandings and assurance just remain a matter of record with no honest attempt to implement the same.

The international conference on human environment held in 1972 particularly emphasised that the discharge of toxic substances or of other substances and the release of heat in such quantities or concentrations as to exceed the capacity of the to render them harmless must be halted in order to ensure that serious or irreversible damage is not inflicted upon eco-systems.

### **Legal Remedies**

The important attempts to deal with pollution—air and water are contained in the Water Pollution Control Act of 1974 and the Air Prevention and Control of Pollution Act of 1981. The Act provides for the constitution of a central board for the prevention and control of water pollution as well as State boards for the purpose.

The act prohibits every person from causing any poisonous, obnoxious or polluting matter in accordance with the standard laid down by the State boards. The constitution of the State boards as prescribed by the act broadly ensures that persons having considerable experience in the field of water pollution and problems connected with it will be laying down the standards and parameters for the effluents. It is reasonable to expect that the norms so laid down will take adequate care of both the economic interests of efficient production and the ecological interests of preserving the quality of our environment.

The air pollution act makes substantially the same provision and also provides for the constitution of central and State boards. The State boards, under this act, also consist of persons of considerable experience in the field of air pollution.

The State boards have been authorised to lay down standards for emission of air pollutants into the atmosphere from industrial plants and automobiles or for discharge of any air pollutant into the atmosphere from any other source.

### **Anti-pollution Laws**

*Present Status:* All States have constituted State pollution control boards to monitor air and water quality and to take action against offenders. The record of the ineffectiveness of these boards is far more greater than their success.

The real failure is reflected in site selection policy. Industrial projects are wrongly justified in terms of developments and employments, irrespective of the opinion that may be given by experts. Consent is mostly sought after the completion of the project making it impossible to change the site.

Environmentalists had suggested shifting of the Mathura refinery from the upwind direction of Taj Mahal to another downwind site. A case of Dharmshi Morarjee touched off furious argument as it preferred to surrender the industrial licence rather than to shift the location of the fertiliser plant to Nhava Sheva in Maharashtra.

Notwithstanding the fact that nearly 80 per cent of industries of Maharashtra are located in Bombay. New industries continue to be set up in the city, totally ignoring site selection policy.

More than two decades ago in 1962 Delhi Administration had asked 20 major polluting industries to shift from the crowded part of the city. Yet all of them are there, emitting poisonous pollutants, causing health problems. Pollution control boards cannot shut down a factory for disregarding safe pollution levels but can only prosecute the offender in civil courts where the cases drag on for a long time.

Since the cases involving issues of environmental pollution, ecological destruction and conflicts over natural resources are increasingly coming up for adjudication and these cases involve assessment and evaluation of scientific and technical data, it might be desirable to set up environment courts with one professional judge and two experts drawn from the ecological sciences research groups keeping in view the nature of the case and the expertise required for its adjudication. At present there

is no independent and competent machinery to generate gather and make available the necessary scientific and technical information.

For this purpose, the Government must enact a comprehensive law with the following features:

- (a) The bill should incorporate a provision by which the norms and standards prescribed by the boards constituted under the water pollution act and air pollution act became automatically incorporated in the proposed act.
- (b) The bill should provide for the establishment of an environmental research group "consisting of independent, professionally competent experts who would act as an information bank for the court and government departments" as suggested by the Supreme Court of India.
- (c) The bill should empower the new group to review and revise the norms and standards laid down by the State boards and also on its own prescribe new standards depending upon the circumstances.
- (d) The research group should be vested with all necessary powers for inspection, taking samples, analysis, etc.
- (e) No prosecution for violation of the standards should be instituted except with the concurrence of this group.
- (f) The bill should make an express provision that criminal prosecution may be commenced against the occupier/manager of a factory violating the Environmental laws.

## 9. POLLUTION CONTROL : SOME STEPS

Haryana State Pollution Control Board has found that uncontrolled urbanisation has contributed to the growing population and pollution. Further the unchecked mushrooming of unauthorised and unapproved factories in the non-conforming areas have also aggravated the problem. Board has identified about 1000 industrial units which have failed to instal their sewage water treatment plants and thereby violate the air and water pollution control laws.

The board has already approved the proposal for the setting up of common treatment plants at important industrial centres in the State. It may not be possible for individual industry to set up treatment facilities, due to reasons of space or techno-economic viability. Common treatment facilities provide an attractive alternative towards the pollution control. The board proposes to take followup action after every two months against the industrial units which violates the air and water pollution control rules. The Yamunanagar paper mills has installed its own treatment plant at a cost of Rs. 2 crores which would be commissioned shortly. Similar plant has also been set up by the Yamunanagar sugar mills.

#### 10. MATHURA OIL REFINERY POLLUTION CONTROL METHODS

The level of pollution from Mathura refinery is within the norms fixed by the Government and even after its proposed expansion by 1.5 million tonnes per annum, the pollution level will not increase further. The present level of emission of sulphur dioxide the main pollutant from the refinery, is strictly controlled to be within one tonne per hour as per the norms fixed by the Government.

The fuel efficiency of the furnace was being increased from the present level of 75 per cent to 90 per cent. This would bring down the fuel consumption in the refinery, but the level of emission of sulphur dioxide would not increase further and the air quality would be unaffected.

According to the data available from the monitoring stations of the refinery, the level of pollutions had not increased, nor would it increase with the expansion of the refinery. Monitors had been installed at all the furnace stacks of the refinery to continuously monitor the emission of sulphur dioxide from the refinery.

The refinery had a mobile air monitoring van equipped with modern sophisticated equipments to monitor the level of pollution at any desired location. Strict vigilance was being kept for ensuring the proper functioning of the various installed equipments.

The refinery handles both liquid and gaseous pollutants. It has a modern effluent treatment plant to treat liquid effluents of the refinery. The pollutants in the treated liquid effluents are below the specifications stipulated by the pollution boards. The treated water discharged from the refinery is used for irrigation purposes. In the event of the effluents not meeting the specifications, there is a facility to recycle the effluents for reprocessing.

Air quality at Taj Mahal is being monitored by the National Environmental Engineering Research Institute, Nagpur. In fact, monitoring at Taj Mahal was started before the commissioning of Mathura refinery. Report of the monitoring indicated that "there had been a substantial reduction in sulphur dioxide level after the closing down of the thermal power plants at Agra and that there had been no increase in the sulphur dioxide level after the commissioning of the refinery".

Mathura refinery would pose no danger to the Taj and the flora around.

## 11. CONCLUSION

The environment can be considered to be an integral part of health development, since any impact on man's environment also influences his state of well-being or welfare.

Every sector of the nation's economy while trying to develop leaves its impact on environment and therefore, every sector or department of the economy while planning for its growth should at the same time pay adequate attention to the unfavourable impact on environment and take simultaneous steps by devising suitable strategies to minimise and if possible totally eliminate consequent environmental health degradation.

Environment and development are so closely interlinked that separate approaches to either environment or development are piecemeal at best. In the past it was such an approach that was followed.

In the case of India while various departments such as agriculture, industries, oil, minerals and so on look after their own developmental problems and policies, a separate department of environment is supposed to look after the problems of pollution and environmental degradation resulting from

developments in the above departments. Such a disintegrated approach has not been yielding expected results.

India in its Five-Year Plans also followed piecemeal approach to economic development and environmental balance with disastrous consequences so far as environment was concerned. Thus construction of gigantic irrigational projects completely or partially submerged and destroyed vast forests lands with unfavourable impact on rainfall; establishment of industrial and especially chemical and fertiliser factories polluted vast stretches of major rivers; and increasing urbanisation which is totally unplanned has been resulting in increasing slums and squatter colonies—all these things resulting in increasing pollution and environmental degradation.

It is only in recent years that there seems to be some awakening regarding necessity of maintaining environmental balance and attempts are being made to include this aspect in the formulation of Five-Year Plans.

What is needed in addition to mere awareness of environmental degradation and pollution with their disasterous consequences on the health and welfare of mankind is the integrated approach to the problem of economic development and environment and effective implementation of properly evolved policies in this regard.

## CHAPTER 23

# *Community Well-being and Conservation Ethics*

D.B. RAY\*

## INTRODUCTION

As all the World's countries are striving to develop their Industrial capacity through large scale technological activities, profound changes such as migration, depletion of resources of earth and wild life, settlement of new lands, urbanisation and so on are precipitating ecological ills through increasing environmental exploitation. The belief in the innate ability of the techno-economic system and the industrial adjustments to meet the loss of its ecological niche and equilibrium is no longer valid since the basic changes in culture resultant to industrialisation leads to creation of needs that resource base of the country cannot support. The higher the intensity of market transactions in conventional industrial growth model with goods and services involving the environment, the faster is the rate of environmental degradation. Moreover equilibrium between finite character of the physical universe and unlimited nature of man's appetite for economic growth appears to be far

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from conclusive particularly for industrialising societies because of endogenous factors like high growth rate of population. Can we find a general solution for the problem of environmental degradation without disturbing the broad contours of contemporary culture, life style, and technology? To achieve an environment 'of a quality which permits a life of dignity and well-being,' as a fundamental right of man, an understanding of human eco-system processes is essential for designing pertinent future activities towards prevention of environmental degradation—in that not only factors contributing to infectious diseases and to injury from toxicants or physical hazards but also those external to the physiological organism of the individual contributing to chronic diseases, mental illness, addictions, and psychosomatic and other disorders need be analysed scientifically. Hence our concern is no longer in the form of organism *versus* environment or *vice versa* but with the interaction of man and his environment to achieve community well-being. Eco-development through harmonisation of nature and man, therefore, calls for an understanding of social reality in the light of the following main ecological concepts :

- (a) Modified environment or an artefact is an extension of morphologically manifested behaviour of the animal,
- (b) Spatial identity and social use of space,
- (c) Influence of synthetic surroundings where no social structure has developed on genetic and phenotypic behaviour.

### **Modified Environment**

The environment problems created by the Industrial Revolution more than 100 years ago in the most highly developed countries have manifested today differently with increase in juvenile delinquency, crime, alcoholism and mental diseases because we have not tackled these problems from an ecological view-point. We need to recognise that the determinants of well-being of a community are not only related intimately with the animate, *i.e.*, biological environment and the inanimate, *i.e.*, physical and chemical environment but also behavioural, psychological and social environment. In fact the animal's

'behaviour' shows through or is manifest morphologically in the structure of the artefact that is produced *de novo* or by modifying a pre-existing structure and it is nothing but an extension of the animal itself. For example, the study of morphology of the nests of birds is considered to be a better scheme for studying their behaviour. Even from a faulty nest or an artefact it can be inferred that the bird or the animal is socially deranged and unable to carry out the ordinary important aspects of its own behaviour. In describing a bird, the morphology of the bower cannot be separated from the morphology of the species. Can we apply this concept to the study of man? It is generally agreed that a good housewife unknowingly tends to make the home an extension of herself to preserve mental and social health. In case of a home in a city, she accepts an environment as she is obliged to live in an artefact made for her by other people. That leads to stress and strain which can be lessened only by recreational facilities. In such a situation, recreation for the well being would mostly comprise of an escape from human artefacts that have become insufferable without the occupants realising it. In this perspective will the relaxation or recreation be satisfactory and ensure a life full of warmth, interest and variety, if conservation of resources of nature, such as wilderness and wild life are not practised effectively? It will be well conceived through a similar example—the milieu in a super market may be very efficient for transaction but would it be able to replace the social dimension of a neighbouring grocer's shop?<sup>1</sup>

### Space—Identity and Impact

In human and animal ecology, the social use of space and a sense of spatial identity are very important. An interesting example is a window box of plants or an aquarium that adds to the small scale richness of one's spatial identification. The Japanese garden or the structuring in Japanese Inn considers for a place representing a symbolical space; it is advocated that if you cannot get out to wide open spaces then reduce the space, make your mind small and explore in otherways. In fact such miniaturisation influences wonderfully. A full wall size jungle picture on one of the walls of the drawing room in

a city house endows a soothing effect on the nerves; even on a crowded party gathering crampness does not become so intolerable as it would have been otherwise. This is the sense of well-being due to symbolical conservation of wilderness of space. As profession, culture, sex and class play determining roles in a person's fate, spatial identity of his place of birth and upbringing override his adaptability. Hence slum dwellers when relocated to very greatly improved quarters, find the experience much more traumatic than when middle class families are relocated in moderately improved quarters.<sup>2</sup>

### **Influence on Behaviour**

Environmental differences alter behavioural patterns; just as a child needs essential nutrients to develop successfully biologically, so it also requires physiological stimuli and challenges for adequate development. When a genetic urge is frustrated causing stress, abnormal behaviour may ensue. While the basic elements in the behavioural component is almost similar between different races, there are enormous differences in each social system for successful adaptation. We may feel that people living in a shanty or slum are automatically suffering, but that may prove to be wrong since in a sterile synthetic surroundings after demolition of their slums we may put them in socially worse off situation and make them deteriorate. The people constituting the community develops or deteriorates in the locus where their individual biographies and history meet. "To belong appears to be as fundamental as to eat."<sup>3</sup> Scarcity of food supply or built-in neuro-secretory mechanism—what controls population?—it has been witnessed that the present social changes forced on us are so rapid and startling that no longer built-in neuro-secretory mechanisms are to our advantage in very subtle ways. In fact with imposition of modernised 'sterile' condition and no concern for conservation of natural wild life and peoples local horizon, new stresses have been created through neuro-secretory mechanism that alter behaviour, mating habits and resistance to diseases, and may even cause increased foetal loss. The increasing attitude of fatalism with manifest dependency on a 'father figure' as happening today also is resultant to such

stresses from absence of harmony with nature and respect for environment. It is true that human beings, besides history and culture, are influenced by biological rhythms and access to resources, by the level of social productivity and institutional environment.

### **Conservation Ethics and Community Well-being**

We are now convincingly aware that the present techn-economic development models of industrialised civilisation have led not only to :

- (a) Environmental deterioration to the extent of destroying the habitability of our planet, and
- (b) plundering and exhaustion of resources including wild life; but
- (c) has precipitated a gigantic dimension of inequality in levels of living starting from so to say intra-country colonialism to the failure of the monetary system and ensuing dispute over exchange mechanism in the international monetary system especially for third world countries.

If we want to achieve quality of life by optimistic satisfaction of human needs in the present and in the future, we have to liberate ourselves from internal dislocations that are conspicuous with naked ugliness due to imitating posture of handful of elites for achieving equal standards and life styles of industrialised countries for them only. As we have to mobilise people of every social strata for creativity of all levels we have to vouchsafe for socially responsible management of earth. The economics of a consumer society that are in conflict with the conservation ethics of today must of necessity undergo a fundamental orientation, if we have to live at greater peace and equilibrium with ourselves and our environment. A proper starting for this new approach of conservation ethics for community well being would be ensured if we remember the warnings of Bjorn Berglund—"As long as technologies are adopted that run totally counter to the facts of nature and life, as long as the rich exploit poor and pile up their wealths in

ever more violent constructions of inhumanity, catastrophies are unavoidable."<sup>4</sup> To continue in the words of Alexis Carrel further 'the brutal materialism of our civilisation not only opposes the soaring intelligence but also crushes the affective, the gentle, the weak, the lonely, those who love beauty, whose sensibility does not stand the struggle of modern life."<sup>5</sup> With this self-conscious awareness of history of power of science and technology as it relates to man and his wisdom, the highest possible investment of modern societies should be in nurturing the ability of each citizen to form and pass judgements,—to propose, to question, to veto and to defer decisions which affect them—that is to apply a scale of values to the phenomena of human eco-system. People must be allowed to act as subjects, and are not acted upon as objects. They must become ecologically prudent actor in the process of understanding and transforming nature and society so as to maximise for the individual and the whole, the opportunities for self fulfilment.

### **Conclusion**

Whatever is taken out of the earth need be replaced and no more must be taken out than can be replaced or in the words of Leo-Szilard "Do not destroy what you cannot create."<sup>6</sup> Locally or globally there should be no difference to this principal law and it should not be broken—Not by people who try to balance the account with human life, NOT by the world trade and power politics which build up their wealth at the cost of existence. To achieve effectively world wide social control of technology, besides a system of natural resources accounting in material terms need be set up for wise management of earth's capacity to produce them, the scientists of tomorrow need assume greater responsibility to analyse in rational and simple terms all issues affecting eco-system and human being so that conservation becomes a matter of ethics, a true moral imperative for them in co-operation with decision making political authority.

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## CHAPTER 24

# *Environmental Lead Pollution*

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SURJEET SINGH\* and SUNIT SINGH\*\*

R, a 10 month old boy was referred by a doctor from Dehradun to PGIMER, Chandigarh as a case of suspected meningitis (brain fever). Initial investigations were done and the child was started on therapy. She, however, did not respond to treatment and continued to deteriorate. At this time the clinical history was reviewed and it was, almost accidentally, found that the family was making car batteries at home. They had already lost 3 children in the last 4 years, under similar circumstances. Diagnosis of lead poisoning was, therefore, quite apparent in this child. Blood lead levels were subsequently done and were found to be in the toxic range. Necessary drugs were procured and treatment started but approximately two weeks after hospitalization, the baby succumbed to her illness. Family members were also investigated, and all of them were found to have very high blood lead levels; in the children, the levels were in the critical range. Three of us from the Deptt. of Paediatrics then went to Dehradun to gain first hand information on the housing environment. It was found that the concerned family was not only making lead batteries

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at home but they were also melting and processing pure lead. The customary precautions which are mandatory for such industries, were not being observed—the family was virtually living in lead.

This case-history illustrates that there is little information available to general public on the hazards associated with use of lead, and safety measures that should be observed to prevent lead-poisoning. In fact, lead poisoning remains one of the most common environmental hazard, in spite of good body of scientific knowledge on its toxicity, and control measures. The extent of problem in our country is not clearly known. But in an advanced country like USA, there are as many as 2,25,000 children with dangerously high lead levels in the body. And if one realizes that lead poisoning not only results in permanent neurologic handicaps but, in children at least, may also cause case fatalities the tragedy becomes all the more poignant.

The clinical manifestations of lead poisoning are many and varied. The initial symptoms may be so vague and non-specific that the diagnosis is often missed. In adults lead poisoning may present as chronic anemia (lack of blood) not responding to the commonly used drugs. Abdominal pain (Syn. painters cramps) which is often ill-defined and poorly localized, but at times may be severe enough to require hospitalization, is also a common feature. The individual may also suffer from muscle weakness, wrist drops, general malaise and easy fatigability. Subtle intellectual deterioration, defects in memory and alterations in perceptual and cognitive functions are uncommon presenting features but may be responsible for significant disability in the affected individual.

In children, the manifestations of lead poisoning are more overt, the presentation more dramatic and the sequelae in untreated cases often grave. The child initially may have increased irritability, difficulty in concentration and poor school performance. Anemia is less common. Left untreated, many of these children develop fits, dillirium and become unconscious. Often it is only at this stage that the child is brought to medical attention, with the result that even if the child is saved he may be left with permanent neurologic handicaps.

## Epidemiology

Lead poisoning usually occurs following repeated ingestion of lead-contaminated food and water, over a long period of time. This can also occur through repeated exposure to air contaminated with lead-fumes.

Adults absorb only 5-10% of ingested lead and retain little of it. Young children, on the other hand, not only absorb 40-50% of the ingested lead, but also retain much larger amounts (20-25%).

The single most important host factor for young children is 'pica', i.e., eating of materials not usually considered appropriate, i.e., clay, sand, earth, paper wood, paint, plaster, etc. Lead poisoning has occasionally followed the use of nipple shields, accidental ingestion of lead toys and drinking of water conveyed through lead pipes.

Dietary factors may also contribute to the poisoning. Diets deficient in calcium and iron are often prevalent in children coming from lower socio-economic strata. These deficiencies are known to increase absorption of lead from the intestines.

## Important Environmental Factors at Home

The principal environmental source remains the old slum tenement. Many of these dwellings have been coated with lead containing paints. Structures in poor repair often have lead-containing chips or pulverized fragments in the household dust. Similarly play areas, dirty playgrounds and dirty yards and vacant lots containing lead painted houses should be identified as potential lead sources. Studies in USA, reveal that 50-70% of old houses had dangerous amounts of flaking paint containing lead on interior walls. Since 1950, lead containing interior paints have not been available commercially in many countries. Buildings constructed since that period are much less of a hazard. Fresh painting of old buildings does not, of course, reduce the hazard since the initial lead deposits are not removed.

In India, use of 'surma', and some brands of 'Kajal' contain very high amount of lead. Lead poisoning in children has been traced to regular use of these agents.

## Important Environmental Factors in the Industry

The so-called 'lead trades' include, but are not limited to :

- (a) Storage battery manufacture and repair.
- (b) Lead-scrap smelting.
- (c) Secondary lead smelting (*i.e.*, recovery of lead from old storage batteries).
- (d) Printing presses and the like. Metal founding.
- (e) Automobile assembly and body and radiator repair.
- (f) Demolition and renovation of old houses and lead-painted metal structures.

Proximity to lead smelters, ingestion of lead dust and inhalation of lead fumes from combustion of petrol contributes to overall body burden of lead in children. In a study conducted in Idalno, USA, 99% of children aged 1-9 living within 1-6 km of the main smelter stack had high blood lead levels while 22% had lead levels in the dangerous toxic range. In that area the airborne concentration varied from 10  $\mu\text{g}/\text{m}^3$ -17  $\mu\text{g}/\text{m}^3$ . There was a sharp decrease in pollution and in the incidence of high blood levels of lead beyond 4 km. The inhalation of lead fumes was also supplemented by increase of lead in soil and vegetation.

## Miscellaneous Factors

Lead poisoning has also resulted from fermented beverages stored in lead vessels, from drinking illicit liquor prepared in stills made from lead plumbing/automobile radiators and from use of improperly glazed pottery.

## PREVENTIVE MEASURES

### At Home

(A) If lead-paint in home is the principal source of lead poisoning, following measures should be taken:

- (a) Remove all lead based paint from walls/woodwork. Removal by burning and sanding is very popular and is

considered an effective method. However, while the process is being carried out, there is a greatly increased amount of air and dustborne lead in the home environment. It is of the utmost importance, therefore, to remove all children and pregnant mothers from the dwelling until the process is completed.

- (b) Sweeping with a broom should be forbidden since it serves only to stir up small dust particles. Wet mopping is the preferred mode of cleaning.
- (c) All floors and woodwork must be scrubbed weekly. This should be supplemented with daily damp dusting with a cloth rinsed in the same detergent.
- (d) Meticulous hand-washing before meals is very important.
- (e) Efforts should be made to excavate the dwelling as soon as feasible.

(B) Use of *surma* and *kajal* should be avoided.

### **In the Industry**

- (a) Effective exhaust ventilation is essential.
- (b) Adults working in the so-called 'lead trades' must shower before coming home and must leave all work clothes, including shoes, at the work place. These must not be washed/cleaned at home.
- (c) Use of overalls and gloves while at work, should be encouraged.
- (d) Periodic monitoring of blood lead levels should be mandatory.

### **Measures at the Community Level**

'Lead-trade' as discussed earlier should not be operated in a residential area, and within the household. The tragedy in the case illustrated earlier could have been avoided, if this measure was observed. If such a trade is being operated, and you happen to know about it; it should be reported to the local public health authorities who usually have primary responsibility for environmental investigation and abatement

of lead hazards. In case of lead poisoning in a community a team approach involving public health personnel, paediatricians and social workers is likely to be most effective. Assistance for obtaining safe housing should be obtained from social organizations.

### **Treatment**

Once a diagnosis of lead poisoning is made before the patient is moribund, complete cure may be expected. In most cases, however, only a guarded prognosis can be given. The treatment is expensive and the drugs not easily available in our country. Needless to say, however, once lead poisoning is suspected the single most important step is to prevent further exposure by withdrawing the concerned patient completely from the offending environment at home/industry.

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